

**Fire Effects on Cultural Resources
A Bibliographic Survey of Specific and Related Literature**

**Bureau of Land Management
Bishop Field Office
785 N. Main Street, Suite E.
Bishop, CA 93514**

Compiled for the BLM Preservation Board by

**Kirk Halford
Bishop Field Office Archaeologist**

2001

NCS Data Base

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

July 26, 2001

In Reply Refer To:
8100 (240)P

EMS TRANSMISSION 07/30/2001
Information Bulletin No. 2001-131

To: All Field Officials
Attn: Cultural Program Leads
Fire Management Specialist

From: Group Manager, Cultural Heritage, Fossil Resources & Tribal Coordination

Subject: Bibliographic Sources Regarding the Effects of Fire on Cultural Properties.

The attached bibliography, "Fire Effects on Cultural Resources: A Bibliographic Survey of Specific and Related Literature" was compiled by Kirk Halford of the Bishop Field Office for the Bureau of Land Management (BLM) Preservation Board. The bibliography is not exhaustive, but represents an excellent starting point for anyone investigating the subject. We are grateful to Kirk for his willingness to take on this task. The diversity of topics addressed among the references of the bibliography is extensive; ranging from the effects of fire on the radiocarbon dating of the Shroud of Turin (Long 1998), to experiments in the replication of fire-cracked rock (House and Smith, 1975), to a model for assessing and treating sites using fire rehabilitation funds (Sydoriak, et.al.1998).

This is a compilation of references. It is divided into five sections, based on their source. Some are annotated, and many are not. The sections are organized in no particular order, and there may be some duplication between sections. The "Fire Management Section" contains an article by Paul Nickens entitled "The Destruction of Archaeological Sites" that is worthwhile reading for a broad perspective about sources of archaeological site destruction, and includes bibliographic references worth looking over. Particularly useful bibliographic references are provided at the final section entitled, "Western Archaeological & Conservation Center Draft Bibliography of Fire Effects on Cultural Resources."

The literature indicates that there are no simple answers to questions about how fire affects cultural resources, or how cultural resources should be considered and managed under the National Fire Program. Many variables must be accounted for in any effort to anticipate the effects of any particular fire on any particular cultural resource. For example, anticipating the effects of fire on a cultural deposit may require that the sediments in which it occurs be assessed

for moisture, chemistry and composition. Evidently, moist, compact, small-grained soils low in organic content transfer less heat below the surface than dry, loose, organic, coarse soils. Fuel

2

load is also a variable to consider. Some fuel types burn much hotter and with longer duration than others. Some fuels have deep root systems which may smolder for days raising dramatically the subsurface temperature adjacent to the root and any cultural materials there. Some cultural materials are more vulnerable to fire effects than others. Cultural materials of wood or paper are, of course, more flammable than others such as stone or metal. However, any cultural material, sufficiently heated, will be the worse for wear.

In addition to understanding the relevant variables of a particular fire event, we must also consider the cumulative effects of repeated fires through time. Some have argued that archaeological sites in fire prone areas have been burned before, and we shouldn't be overly concerned about burning them again. A single fire event may not appear to affect dramatically a particular archaeological property, but what happens to the integrity of the property after exposure to repeated fire events, or high intensity burns? Similarly, how do we account for cultural materials spared by the heat of a fire, but subjected to the effects of post-fire exposure and erosion, or subsequent restoration and rehabilitation actions? Again, the answers to these questions depend on many variables that are difficult to quantify, and in many instances, there is simply no reliable data upon which to base an answer.

The difficulty inherent in anticipating the effects of fire on cultural resources means we need to be well versed about investigations that are available in the literature in order to more fully integrate cultural heritage issues into the wildland fire program. Where possible and applicable, information derived from these and other sources should be used for building prescriptions and conditions to fire plans and fuel reduction activities that are responsive to both the fragility and durability of various types of cultural resources.

If you have questions concerning this publication or historic preservation in the light of fire-related activities, please feel free to contact Alan Stanfill, WO-240, at (303) 236-1734.

Signed by:
Marilyn W. Nickels, Ph.D.
Group Manager, Cultural Heritage,
Fossil Resources & Tribal Coordination

Authenticated by:
Barbara J. Brown
Policy & Records Group, WO-560

1 Attachment

1 - Bibliography (113 pp)

Directives forwarded to State Director, CA-930, R. Laidlaw, R. Kaldenberg, CA-940, CA-943, J. Francis 07/30/01

Fire Effects Bibliography

From DOI/BLM/NCS

Contact Barbara Campbell: 303-236-6488

12/14/2000 Kirk Halford

Search of BLM library catalog for: **FIRE EFFECTS and ARCHAEOLOGY**

2 titles:

Author : Lent, Stephen C.
Author : Gaunt, Joan K.
Author : Willmer, Adisa J.
Author : Museum of New Mexico. Office of Archaeological Studies.
Author : U. S. Forest Service.
Author : Rocky Mountain Forest and Range Experiment Station (Fort Collins, Colo.)
Title : **Fire effects on archaeological resources, Phase I : the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico**
Call number : USFS G T R R M-273
Publisher : Fort Collins, Colo. : Rocky Mountain Forest and Range Experiment Station
Collation : ii, 103 p. : ill., maps ; 28 c
Series : General technical report RM ; 273
Subject : ARCHAEOLOGY--EFFECT OF FIRE ON.
Subject : ARCHAEOLOGY--NEW MEXICO.
Subject : INDIANS OF NORTH AMERICA--NEW MEXICO--ANTIQUITIES.
Subject : NEW MEXICO--ANTIQUITIES.
Subject : CULTURAL PROPERTY--PROTECTION--NEW MEXICO.
Added entry : General technical report RM ;
Notes : March, 1996. Includes bibliographical references.

Author : Lent, Stephen C.
Author : Gaunt, Joan K.
Author : Willmer, Adisa J.
Author : Maxwell, Timothy D.
Author : Museum of New Mexico. Office of Archaeological Studies.
Author : U. S. Forest Service.
Author : U. S. Bureau of Land Management.
Title : **A Study of the effects of fire on archaeological resources, Phase I : the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico**
Call number : E 78 .N65 L466 1992
Publisher : Santa Fe, N.M. : Museum of New Mexico, Office of Archaeological Studies
Collation : viii, 159 p. : ill., maps ; 28
Series : Archaeology notes (Museum of New Mexico) ; no. 93.
Subject : ARCHAEOLOGY--EFFECT OF FIRE ON.
Subject : ARCHAEOLOGY--NEW MEXICO.

Subject : INDIANS OF NORTH AMERICA--NEW MEXICO--ANTIQUITIES.

Subject : NEW MEXICO--ANTIQUITIES.

Added entry : Archaeology notes (Museum of New Mexico) ;

Notes : 'A joint project between the Office of Archaeological Studies (OAS), Museum of New Mexico, and the United States Forest Service'--P. 1. 'The Bureau of Land Management, Santa Fe, and the National Park Service, Bandelier National Monument contributed to the project through participation and discussion sessions'--P. 1. 'MNM Project No.41.521 ; USFS Agreement No.28-C2-591'--P. ii.

Search of GEOREF for keywords: **fire/burn AND effects/impacts AND archaeology**
11 citations

Record 1 of 11 - GeoRef Disc 5: 1997-1999/10

TI: Attempt to affect the apparent (super 14) C age of cotton by scorching in a CO (sub 2) environment.

AU: Long-Austin

AF: University of Arizona, Department of Geosciences, Tucson, AZ, United States

BK: In: Proceedings of the 16th international radiocarbon conference; Part 1.

BA: Mook-Willem-G (editor); van-der-Plicht-Johannes (editor)

SO: Radiocarbon. 40; 1, Pages 57-58. 1998.

PB: University of Arizona, Department of Geosciences. Tucson, AZ, United States. 1998.

CP: United-States

PY: 1998

CN: 16th international radiocarbon conference. Groningen, Netherlands. June 16-20, 1997.

LA: English

AB: One explanation for the radiocarbon dates on the Shroud of Turin being younger than the time of Christ is that the heat from a fire, which scorched a portion of the Shroud, may have affected the (super 14) C content (dates) on the shroud by affecting molecular exchange between the fabric and atmospheric carbon. This report describes a laboratory test on the susceptibility of cellulose, in the form of cotton, to incorporate carbon from CO (sub 2) while it is heated in a closed tube with carbon dioxide until the cotton considerably darkened. To maximize the effect of this hypothetical process, we simulated the shroud material with cotton that had a (super 14) C level of 0.55 modern (55 pMC, equivalent to 4800 yr), and the atmosphere with pure CO (sub 2), which had a (super 14) C level of 1.3 modern (130 pMC). No measurable (super 14) C transferred from the gas phase to the solid phase. The implication of this test is that scorching is an unlikely mechanism to affect the apparent age of cellulose-like material.

DE: absolute-age; accuracy-; archaeology-; atmosphere-; C-14; carbohydrates-; carbon-; carbon-dioxide; cellulose-; cotton-; experimental-studies; heating-; isotopes-; laboratory-studies; organic-compounds; polysaccharides-; radioactive-isotopes

CC: 03-Geochronology

DT: Serial; Conference-Document

BL: Analytic

IL: Refs: 3; 1 table.

RF: GeoRef, Copyright 1999, American Geological Institute.

IS: 0033-8222

CO: RACAAT
AN: 1999-044436
UD: 199916

Record 2 of 11 - GeoRef Disc 5: 1997-1999/10

TI: Ecosystems archaeology in comparative morphostratigraphic studies of multicomponent archaeological sites on sand deposits in central Saskatchewan.

AU: Ponomarenko-Elena-V

AF: Archaeological Survey of Canada, Canadian Museum of Civilization, Hull, PQ, Canada

BK: In: Geological Society of America, 1998 annual meeting.

BA: Anonymous

SO: Abstracts with Programs - Geological Society of America. 30; 7, Pages 217. 1998.

PB: Geological Society of America (GSA). Boulder, CO, United States. 1998.

CP: United-States

PY: 1998

CN: Geological Society of America, 1998 annual meeting. Toronto, ON, Canada. Oct. 26-29, 1998.

LA: English

AB: In prairie ecosystems on sand sediments, natural disturbances such as fires, grazing and droughts easily cause mobilization and lateral migration of the substratum. The sets formed include buried soil components and the deposits separating them. The number and thickness of the layers have a high spatial heterogeneity. The soil components are either organogens, such as sod or pyrogenic layers, which accumulated on the former surface, or the results of local embedding into the substratum by pedoturbation. A standard "horizon" approach is not applicable either for genetic analysis of these formations or for revealing the isochronal formations in different loci. The "Ecosystems Archaeology" method was applied to archaeological sites to reveal diagnostic morphological features (morphons), which correspond with particular ecosystem parameters such as species of fossorial fauna, type of vegetation, types and seasonality of fires, and impact of ungulates. Radiocarbon dates of processed bones from occupation layers were used to reveal isochronal formations in different sites. These two approaches combined made it possible to identify causes and frequency of material mobilization. They showed that the most significant single sand depositions (particularly dune shifts) were caused by the impact of ungulates. They were asynchroneous for different locations. Single episodes of fire-caused sand mobilization were asynchroneous in different sites but sets of fire-caused layers showed an increase in fire frequency and decrease in a quantity of mobilized material starting from 2000-2500 yr BP. This, in combination with an increase in humidity in this period shown by paleolimnologic data, supports anthropogenic origination of the fires. Drought-driven eolian sedimentation from lake shores was most obvious on watersheds. The morphology showed two periods of intense accumulation, divided by a period of stabilization about 5000 BP. In layers older than 4500-4000 BP, there was no contemporaneous evidence of fossorial rodents. The appearance of abundant traces of fossorial rodents on the watersheds corresponded to the end of the second long-term drought. These examples show that ecosystems archaeology can extend paleoecological reconstructions based on limnological approach.

DE: absolute-age; archaeological-sites; archaeology-; bones-; C-14; Canada-; carbon-; Cenozoic-; central-Saskatchewan; clastic-sediments; climate-change; composition-; ecosystems-;

fires-; Holocene-; isotopes-; paleoecology-; paleoenvironment-; Quaternary-;
radioactive-isotopes; reconstruction-; sand-; Saskatchewan-; sediments-; soils-;
spatial-variations; Western-Canada
CC: 24-Quaternary-geology
DT: Abstract; Serial; Conference-Documnt
BL: Analytic
RF: GeoRef, Copyright 1999, American Geological Institute. Reference includes data supplied
by the Geological Society of America, Boulder, CO, United States
IS: 0016-7592
CO: GAAPBC
AN: 1999-039582
UD: 199914

Record 4 of 11 - GeoRef Disc 1: 1785-1974

TI: Man the destroyer; late Quaternary changes in the Australian marsupial fauna.
AU: Merrilees-D
SO: Journal of the Royal Society of Western Australia. 51, Part 1; Pages 1-24. 1968.
PB: Royal Society of Western Australia. Perth, West. Aust., Australia. 1968.
CP: Australia
PY: 1968
LA: English
AB: Hypotheses regarding the cause of late Quaternary extinction of marsupials in Australia are examined. It is postulated that extensive use of fire by early man could have had a marked effect on ecosystems, and thereby might have been the major factor contributory to the extinction of many species of large marsupials, rather than extreme aridity. Correlations are made between the advent of man and mass extinction in Australia and elsewhere in the world. Fossil assemblages and artifacts at Billabalong, Wonberna, Guralia, and Devil's Lair in Western Australia are cited as evidence of the early association of man and now extinct marsupials. However, since present data are inconclusive, further study of archaeology, geomorphology, and carbon-14 dates is recommended. A comprehensive bibliography is included.
DE: Australasia-; Australia-; Cenozoic-; Chordata-; evolution-; extinction-; Mammalia-; Marsupials-; paleontology-; Quaternary-; regional-; Tetrapoda-; Vertebrata-
CC: 11-Vertebrate-paleontology
DT: Serial
BL: Analytic
IL: illus. incl. sketch map.
RF: GeoRef, Copyright 1998, American Geological Institute. Reference includes data from Bibliography and Index of Geology Exclusive of North America, Geological Society of America, Boulder, CO, United States
IS: 0035-922X
CO: JRSUAU
AN: 68-11373
UD: 1968

Record 5 of 11 - GeoRef Disc 3: 1985-1992

TI: Evidence from the Swartkrans cave for the earliest use of fire.
AU: Brain-C-K; Sillen-A
AF: Transvaal Mus., Pretoria, South Africa
SO: Nature (London). 336; 6198, Pages 464-466. 1988.
PB: Macmillan Journals. London, United Kingdom. 1988.
CP: United-Kingdom
PY: 1988
LA: English
DE: Africa-; archaeological-sites; archaeology-; bones-; burnt-bones; caves-; Cenozoic-; Chordata-; Eutheria-; fire-; Hominidae-; Mammalia-; Orange-Free-State-South-Africa; paleoecology-; Pleistocene-; Primates-; Quaternary-; South-Africa; Southern-Africa; stratigraphy-; Swartkrans-; Tetrapoda-; Theria-; thermal-effects; Vertebrata-
CC: 24-Quaternary-geology
DT: Serial
BL: Analytic
IL: Refs: 7; illus. incl. 1 table, sketch maps.
RF: GeoRef, Copyright 1998, American Geological Institute.
IS: 0028-0836
CO: NATUAS
AN: 89-07450
UD: 1989

Record 7 of 11 - GeoRef Disc 4: 1993-1996

TI: Biogeochemical record of ancient man.
AU: Fogel-Marilyn-L
AF: Carnegie Institution of Washington, Geophysical Laboratory, Washington, DC, United States
BK: In: Geological Society of America, 28th annual meeting.
BA: Anonymous
SO: Abstracts with Programs - Geological Society of America. 28; 7, Pages 22. 1996.
PB: Geological Society of America (GSA). Boulder, CO, United States. 1996.
CP: United-States
PY: 1996
CN: Geological Society of America, 28th annual meeting. Denver, CO, United States. Oct. 28-31, 1996.
LA: English
AB: Humans, omnivorous animals capable of thought, can consciously influence their own physiological state and thereby affect to some extent the biochemical and isotopic contents of their bodies. In addition, because man has developed various levels of technology, e.g., the use of fire, he has been able to sway regional and possibly global climate. Paleodietary studies of humans are important, as hunting and gathering, horticulture, or pastoralism were primary pursuits for much of man's history. Stable isotopic records from archaeological skeletal remains provide the material for study and interpretation, when written or other archaeological records do not exist. For example, on Easter Island, a thriving culture once existed 1-2 kA ago, but owing to

starvation and possible cannibalism, the society withered to its current present levels. Were these people able to take advantage of the rich marine food sources of their island? Or did they never develop the necessary boating and fishing technology? Examples of the spread of important food sources into the Americas, the duration of nursing of infants and the timing of weaning, and the movement of people between continents will be explained with geochemical data. A challenge still exists to find a long-term record of human influence on regional or continental climate. The persistent use of fire by early Aborigines in Australia may have resulted in altered vegetation and a decreased ability of the ecosystem to retain water in plants and soils, thus effecting climate change. Isotopic evidence for the past 50 kA from the Lake Eyre Basin, Central Australia, will be presented.

DE: archaeology-; Australasia-; Australia-; biochemistry-; Cenozoic-; changes-; climate-; ecosystems-; geochemistry-; Holocene-; isotopes-; Lake-Eyre-Basin; Plantae-; Quaternary-; soils-; South-Australia; stable-isotopes

CC: 24-Quaternary-geology

DT: Abstract; Serial; Conference-Document

BL: Analytic

RF: GeoRef, Copyright 1998, American Geological Institute. Reference includes data supplied by the Geological Society of America, Boulder, CO, United States

IS: 0016-7592

CO: GAAPBC

AN: 97-40244

UD: 199714

Record 8 of 11 - GeoRef Disc 4: 1993-1996

TI: Fracture and burn patterns of fire altered rock.

AU: Athan-Heidi-K

AF: University of Nebraska, Department of Anthropology, Lincoln, NE, United States

BK: In: Proceedings of the Nebraska Academy of Sciences; 1880-1995, including the NATS & TER-QUA divisions and affiliated societies; one hundred-fifth annual meeting.

BA: Zechmann-Albert (chairperson)

SO: Proceedings of the Nebraska Academy of Sciences and Affiliated Societies. 105; Pages 6. 1995.

PB: Nebraska Academy of Sciences. Lincoln, NE, United States. 1995.

CP: United-States

PY: 1995

CN: Proceedings of the Nebraska Academy of Sciences; one hundred-fifth annual meeting. Lincoln, NE, United States. April 28-29, 1995.

LA: English

DE: archaeology-; detection-; effects-; erosion-; experimental-studies; fires-; fractures-; hearths-; middens-; moisture-; Nebraska-; Oglala-National-Grassland; patterns-; rocks-; thermal-alteration; United-States

CC: 24-Quaternary-geology

DT: Abstract; Serial; Conference-Document

BL: Analytic

RF: GeoRef, Copyright 1998, American Geological Institute.

IS: 0077-6343
CO: PNBAAP
AN: 95-44220
UD: 199516

Record 9 of 11 - GeoRef Disc 4: 1993-1996

BK: Quaternary paleoclimate variation as evidenced by Paleosols; implications for anthropogenic impact on landscape instability around an Anasazi site in Kane County, Utah.

BA: Kulp-Thomas-R

CP: United-States

PY: 1995

DG: Master's

DI: East Carolina University. Greenville, NC, United States. Pages: 199.

LA: English

AB: Geochemical and classic geological techniques used to interpret the pedogenesis of floodplain soils formed between AD 100 and the present suggest anthropogenic causes for landscape instability in southern Utah. Previous workers have suggested that the Anasazi civilization that inhabited the study area abandoned it around AD 1150 because of changes in regional precipitation patterns. Floodplain paleosols, however, do not show evidence for significant long term climatic variability. The Quaternary stratigraphy of the study area is represented by three major sedimentary sequences that date to the Pleistocene and Holocene and are characterized by multiple episodes of alluvial erosion and sedimentation. Paleosols in these alluvial strata represent periods of active pedogenesis during times of minimal deposition. The character of the paleosols demonstrates relatively little variation in macroscopic or micro-morphologic features. The Pleistocene soils are almost exclusively Haplargids and Calciorthids and Holocene soils are characterized by Calciorthids and Entisols. The stable isotopic ratios of paleosol-carbonates indicate that C (sub 4) plants were the predominant vegetation for each soil. Rainfall estimates from the depth to soil calcic horizons suggest that rainfall may have been slightly higher at the time of maximum Anasazi habitation (around AD 1000), but paleosol data do not indicate a significant climatic change in the Quaternary. Whereas the paleosols in the fill units show little variation over time, the cut and fill events themselves tend to increase in magnitude over time. This increased erosion through time in the absence of increased rainfall, along with the abundance of charcoal in the fill units, suggests that the Anasazi were clearing the surrounding land by slash-and-burn agricultural methods. Dendroclimatic reconstructions by other workers suggest that yearly and decadal variations in paleoclimate may also have contributed to landscape instability in the area. The resulting erosion would have served to make the area less suitable for an agriculturally based civilization, and could have contributed to the Anasazi's decision to abandon the area.

DE: archaeological-sites; archaeology-; Calciorthids-; Cenozoic-; climate-; Entisols-; erosion-; Haplargids-; Holocene-; human-activity; Kane-County-Utah; landscapes-; micromorphology-; paleoclimatology-; Paleosols-; pedogenesis-; Quaternary-; soil-erosion; soils-; stability-; United-States; Utah-

CC: 24-Quaternary-geology

DT: Thesis-or-Dissertation

BL: Monograph

MC: LAT: N370000; N373200; LONG: W1104000; W1125500.

IL: Refs: 41; illus. incl. 6 tables.

RF: GeoRef, Copyright 1998, American Geological Institute.

AN: 96-65620

UD: 199620

Record 10 of 11 - GeoRef Disc 4: 1993-1996

TI: The development of high moorland on Dartmoor; fire and the influence of Mesolithic activity on vegetation change.

AU: Caseldine-Chris; Hatton-Jackie

AF: University of Exeter, Department of Geography, Exeter, United Kingdom

BK: In: Climate change and human impact on the landscape; studies in palaeoecology and environmental archaeology.

BA: Chambers-F-M (editor)

SO: Pages 119-131. 1993.

PB: Chapman and Hall. London, United Kingdom. 1993.

CP: United-Kingdom

PY: 1993

LA: English

DE: Cenozoic-; charcoal-; climate-; Dartmoor-; deforestation-; Devonshire-England; England-; Europe-; fires-; floral-studies; grazing-; Great-Britain; Holocene-; human-activity; Mesolithic-; miospores-; modern-; organic-residues; palynomorphs-; peat-; pollen-; Quaternary-; sediments-; Stone-Age; United-Kingdom; vegetation-; Western-Europe

CC: 24-Quaternary-geology

DT: Book

BL: Analytic

IL: illus. incl. sketch map.

RF: GeoRef, Copyright 1998, American Geological Institute.

IB: 0-412-46200-1

AN: 95-54125

UD: 199520

Search of AGRICOLA for keywords: **fire/burn AND archaeology/cultural resources**
123 citations

Record 1 of 123 - AGRICOLA 1998-2000/09

AN: IND 22053434

UD: 200009

AU: Hornberg,-G.; Ostlund,-L.; Zackrisson,-O.; Bergman,-I.

TI: The genesis of two Picea-Cladina forests in northern Sweden.

SO: J-ecol. Oxford : Blackwell Science Ltd. Oct 1999. v. 87 (5) p. 800-814.

CN: DNAL 450-J829

PA: Foreign

PY: 1999
LA: English
CP: England; UK
CO: JECOAB
IS: ISSN: 0022-0477
NT: Includes references.
PT: Article
SF: IND
DE: forests-. stand-development. cladonia-. picea-. vegetation-. plant-communities.
disturbed-land. history-. paleoecology-. pollen-analysis. charcoal-. dendroclimatology-. maps-.
climatic-factors. grazing-. logging-. shrubs-. sweden-.
CC: F300; K001
AB: 1. In northern Fennoscandia a rare forest type, characterized by Cladina species and Picea abies, occurs on dry productive sites outside the range of permafrost but close to the Scandes mountains. 2. We determined the history of vegetation development and disturbance of two Picea-Cladina forests to test the hypothesis that this forest type has a natural origin. 3. We used a combination of several retrospective vegetation history and archaeological methods, i.e. the analysis of pollen, macroscopic charcoal, dendroecological data, written historical sources, maps and ancient remains. 4. The results suggest that the Picea-Cladina forests investigated are not the products of purely natural factors. 5. Under the influence of harsh climatic conditions and anthropogenic impact, mainly by repeated fires, grazing, trampling and probably also selective cutting of Pinus, mixed coniferous forests, dominated by feather mosses and dwarf shrubs, may have evolved into the Picea-Cladina type. 6. Repeated anthropogenic use of fire, already established c. 2000 years ago, may have been used to create lichen-dominated areas, initially to attract game but later to improve winter grazing resources for reindeer. This finding contradicts the general view that Saami nomads did not use fire to alter forest vegetation.
XAU: Swedish University, Umea.

Record 2 of 123 - AGRICOLA 1998-2000/09

AN: IND 21971943
UD: 199903
AU: Bowman,-D.M.J.S.
TI: Tansley Review No. 101. The impact of Aboriginal landscape burning on the Australian biota.
SO: New-phytol. Cambridge : Cambridge University Press. Nov 1998. v. 140 (3) p. 385-410.
CN: DNAL 450-N42
PA: Foreign
PY: 1998
LA: English
CP: England; UK
CO: NEPHAV
IS: ISSN: 0028-646X
NT: Includes references.
PT: Article
SF: IND

DE: wildfires-. palynology-. aborigines-. landscape-. burning-. history-. ecosystems-. habitats-. paleoecology-. archaeology-. fauna-. extinction-. geomorphology-. environmental-impact. nature-conservation. biodiversity-. vegetation-. plant-communities. erosion-. literature-reviews. fire-ecology. fire-effects. plant-colonization. australia-.

CC: F300

XAU: Northern Territory University, Australia.

Record 3 of 123 - AGRICOLA 1998-2000/09

AN: IND 21379658

UD: 9809

AU: Ogden,-J.; Basher,-L.; McGlone,-M.

TI: Fire, forest regeneration and links with early human habitation: evidence from New Zealand.

SO: Ann-bot. London ; New York : Academic Press,. June 1998. v. 81 (6) p. 687-696.

CN: DNAL 450-An7

PA: Foreign

PY: 1998

LA: English

CP: England; UK

CO: ANBOA4

IS: ISSN: 0305-7364

NT: Includes references.

PT: Article

SF: IND

DE: forest-fires. natural-regeneration. archaeology-. species-diversity. stand-characteristics. radiocarbon-dating. plant-succession. adaptation-. palynology-. climate-. history-. drought-. literature-reviews. paleoecology-. forest-ecology. new-zealand.

CC: F300; K001

AB: New Zealand forests burn less frequently than tussock grasslands, heath or shrublands. Species composition, past disturbance and stand condition determine inflammability and fuel load, and consequent fire intensity and spatial extent. Before people arrived, fires were ignited by lightning during drought years on the eastern sides of both islands. Volcanism occurring every 300-600 years was associated with fires in the central North Island. A review of radiocarbon-dated charcoal from the eastern South Island, and of evidence for fire in pollen profiles from the North Island, provide the basis for an assessment of fire frequency. Forest fires have occurred on both New Zealand's islands throughout the Holocene at least every few centuries, until the last millennium when frequency increased. The 'return time' of fire at any one place in the forested landscape was probably one or two millennia. Burned areas usually succeeded to forest again before the next inflagrations. Consequently fire adaptation is infrequent in the New Zealand flora, and Polynesian forest clearance was rapid and largely permanent. There is an indication of an increase in fire frequency in the late Holocene, and a clear signal associated with people approx. 700 years BP. Separating the earliest anthropogenic fires from the background level of natural burning will be difficult without additional evidence.

Record 4 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236906
UD: 9807
AU: Lentz,-S.C.
TI: Phase II research design.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 90-97.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: archaeological-material. fire-effects. research-. experimental-design. prescribed-burning. fuel-appraisals. temperature-. guidelines-. land-management. historic-buildings. historic-sites. archaeology-. structures-. artefacts-. ceramics-. stones-. rocks-. dendrochronology-. age-determination. hydration-. new-mexico.
ID: fire-intensity. sooting-.
CC: K810; X800

Record 5 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236905
UD: 9807
AU: Lentz,-S.C.
TI: Phase I conclusions.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 84-89.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: artefacts-. historic-buildings. fire-effects. archaeology-. archaeological-material. historic-sites. damage-. forest-fires. age-determination. tuff-. building-materials. subsurface-layers. fuel-appraisals. ceramics-. stones-. rocks-. management-. fire-control. new-mexico.

ID: fire-intensity. sooting-. spalling-.
CC: X800; K810

Record 6 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236904
UD: 9807
AU: Origer,-T.
TI: Obsidian hydration.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 81-83.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: artefacts-. stones-. rocks-. hydration-. fire-effects. archaeology-. archaeological-material. historic-sites. historic-buildings. damage-. forest-fires. new-mexico.
CC: X800; K810

Record 7 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236903
UD: 9807
AU: Willmer,-A.
TI: Architectural materials.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 74-80.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: structures-. building-materials. fire-effects. archaeology-. archaeological-material. historic-sites. historic-buildings. damage-. forest-fires. tuff-. oxidation-. reduction-. erosion-. new-mexico.

ID: spalling-.
CC: X800; K810

Record 8 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236902
UD: 9807
AU: Lentz,-S.C.
TI: Lithic artifact analysis.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 65-73.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: artefacts-. stones-. fire-effects. archaeology-. archaeological-material. historic-sites. damage-. forest-fires. spatial-distribution. oxidation-. history-. subsurface-layers. shape-. materials-. surface-area. reduction-. new-mexico.
ID: fire-intensity. sooting-. potlids-. crazing-.
CC: X800; K810

Record 9 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236901
UD: 9807
AU: Lentz,-S.C.
TI: Ground-stone artifact analysis.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 61-64.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND

DE: artefacts-. stones-. fire-effects. archaeology-. archaeological-material. historic-sites.
damage-. forest-fires. spatial-distribution. oxidation-. history-. new-mexico.
ID: fire-intensity. sooting-. spalling-.
CC: X800; K810

Record 10 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236900
UD: 9807
AU: Gaunt,-J.K.; Lentz,-S.C.
TI: Ceramic artifact analysis.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 47-60.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: artefacts-. ceramics-. fire-effects. archaeology-. archaeological-material. historic-sites.
damage-. forest-fires. spatial-distribution. oxidation-. history-. subsurface-layers. new-mexico.
ID: fire-intensity. sooting-. spalling-.
CC: X800; K810

Record 11 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236899
UD: 9807
AU: Gaunt,-J.K.; Lentz,-S.C.; Willmer,-A.J.
TI: Site descriptions.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 24-46.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND

DE: archaeology-. archaeological-material. historic-sites. historic-buildings. site-factors.
artefacts-. ceramics-. age-determination. masonry-. structures-. new-mexico.
CC: X800

Record 12 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236898
UD: 9807
AU: Lentz,-S.C.
TI: Phase I archaeological field work and methods.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 20-23.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: archaeology-. archaeological-material. field-experimentation. historic-sites.
historic-buildings. temperature-. length-. damage-. site-factors. artefacts-. prediction-.
age-determination. methodology-. fire-effects. forest-fires. wildfires-. new-mexico.
ID: fire-intensity.
CC: X800; K810

Record 13 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236897
UD: 9807
AU: Lentz,-S.C.
TI: Cultural historical background.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 14-19.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND

DE: history-. historic-sites. archaeology-. archaeological-material. american-indians.
new-mexico.
CC: X800

Record 14 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236896
UD: 9807
AU: Lentz,-S.C.; Gaunt,-J.K.; Willmer,-A.J.
TI: Physical environment.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 12-13.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: geology-. forest-fires. site-factors. hydrology-. water-availability. soil-. silt-loam-soils. sandy-loam-soils. alluvial-soils. soil-properties. vegetation-. canopy-. understory-. mountain-forests. environmental-temperature. diurnal-variation. seasonal-variation. rain-. mountain-areas. fauna-. new-mexico.
CC: F300; K001; B200; J200

Record 15 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236895
UD: 9807
AU: Cartledge,-T.
TI: Previous research in the Holiday Mesa, area.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 10-11.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND

DE: archaeological-material. archaeology-. historic-sites. surveys-. inventories-. fire-effects.
forest-fires. new-mexico.
CC: X800; K810

Record 16 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236894
UD: 9807
AU: Cartledge,-T.
TI: Previous fire effect studies.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 9.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: fire-effects. research-. wildfires-. prescribed-burning. damage-. archaeological-material.
archaeology-. monitoring-. historic-sites. soil-.
CC: K810; X800

Record 17 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236893
UD: 9807
AU: Buchanan,-L.; Moody,-R.; Neff,-P.; Cartledge,-T.
TI: Behavior of the Henry Fire in the Jemez Mountains.
ST: General technical report RM ; 273.
SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 4-8.
CN: DNAL aSD11.A42-no.273
PA: USDA
PY: 1996
LA: English
CP: Colorado; USA
NT: Includes references.
PT: Article
SF: IND
DE: wildfires-. fire-control. fire-fighting. dendrochronology-. forest-fires. seasonal-variation.
frequency-. grazing-. fuel-appraisals. fire-effects. damage-. fire-behavior. new-mexico.

CC: K810

Record 18 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236892

UD: 9807

AU: Cartledge,-T.

TI: Research orientation.

ST: General technical report RM ; 273.

SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 3.

CN: DNAL aSD11.A42-no.273

PA: USDA

PY: 1996

LA: English

CP: Colorado; USA

NT: includes references.

PT: Article

SF: IND

DE: wildfires-. archaeological-material. archaeology-. fire-control. artefacts-. monitoring-. forest-fires. historic-sites. prescribed-burning. temperature-. fire-effects. age-determination. new-mexico.

CC: K810; X800

Record 19 of 123 - AGRICOLA 1998-2000/09

AN: IND 21236891

UD: 9807

AU: Lentz,-S.C.

TI: Fire effects on archaeological resources. Phase 1. The Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico.

ST: General technical report RM ; 273.

SO: Fire effects on archaeological resources, phase I the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico /. Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996]. p. 1-2.

CN: DNAL aSD11.A42-no.273

PA: USDA

PY: 1996

LA: English

CP: Colorado; USA

NT: Includes references.

PT: Article

SF: IND

DE: prescribed-burning. wildfires-. archaeological-material. archaeology-. fire-control. management-. artefacts-. forest-fires. forest-management. new-mexico.

ID: fire-management.
CC: K810; X800

Record 20 of 123 - AGRICOLA 1998-2000/09

AN: CAT 10877113
UD: 199911
CA: National Fire Protection Association.
TI: NFPA 909, standard for the protection of cultural resources including museums, libraries, places of worship, and historic properties. 1997 ed.
OT: Standard for the protection of cultural resources including museums, libraries, places of worship, and historic properties.
SO: Quincy, MA : National Fire Protection Association, c1997. 226 p. : ill.
CN: DNAL TH9445.M8-N3-1997
PA: Other-US
PY: 1997
LA: English
CP: Massachusetts; USA
NT: Includes bibliographical references and index.
PT: Monograph; Bibliography
DE: Museums-Fires-and-fire-prevention-Standards-United-States.
Libraries-Fires-and-fire-prevention-Standards-United-States.
Fire-prevention-Standards-United-States.
CC: X200; X600
Record 109 of 123 - AGRICOLA 1992-1997

AN: IND 20535966
UD: 9611
AU: Clark,-J.S.; Royal,-P.D.
TI: Local and regional sediment charcoal evidence for fire regimes in presettlement north-eastern North America.
SO: J-ecol. Oxford : Blackwell Science Ltd. 1996. v. 84 (3) p. 365-382.
CN: DNAL 450-J829
PA: Foreign
PY: 1996
LA: English
CP: England; UK
CO: JECOAB
IS: ISSN: 0022-0477
NT: Includes references.
PT: Article
SF: IND
DE: mixed-forests. fire-ecology. fire-effects. lakes-. pollen-. sediment-. wood-. history-. burning-. pollen-analysis. archaeology-. paleoecology-. forest-ecology. deciduous-forests. minnesota-. ontario-. new-york. maine-. wisconsin-. pennsylvania-.
ID: burned-wood. fire-history.

CC: F300; K001; K810

AB: Presettlement fire regimes in north-eastern North America and their dependence on climate, fuels, and cultural patterns are poorly understood due to lack of relevant historic or palaeoecological data. Annual records of sediment charcoal accumulation were compiled from seven sites spanning the last 2000 years and representing important climate, vegetation, and cultural settings. Results were compared across sites and across changes in Indian cultures to determine whether fire patterns might be explained by one or more of these variables. Clearly interpretable fires were restricted to the western (most xeric) portion of our study region in Pine Hardwoods of Minnesota, a single fire in Northern Hardwoods of northern Wisconsin, and cultural burning near an Iroquois village in southern Ontario. Other sites in Northern Hardwoods and Hardwood-Hemlock forests did not show clear evidence of fire. Spectral analysis suggested instances in which local fire regimes departed from regional ones. Our interpretation suggests substantially longer intervals between fires than reported in previous sediment charcoal studies. We did not find evidence for fire in mixed oak forests, where it has been speculated that fire might be necessary for oak recruitment, suggesting need for further analysis. A single site in northern Wisconsin was the only Algonquin site showing a clear increase in charcoal suggesting local fire. Algonquin use of fire for hunting may not have affected our sites. A single site in Sioux territory experienced such frequent fire that cultural effects were not evident, even when Sioux were replaced by Chippewa (Algonquin) in the 18th century. One of two Iroquois sites showed clear increases in charcoal during.

occupation. The second site may not have had settlements nearby.

XAU: Duke University, Durham, NC.

Record 110 of 123 - AGRICOLA 1992-1997

AN: IND 20523632

UD: 9609

AU: Kirch,-P.V.

TI: Late Holocene human-induced modifications to a central Polynesian island ecosystem.

SO: Proc-Natl-Acad-Sci-U-S-A. Washington, D.C. : National Academy of Sciences,. May 28, 1996. v. 93 (11) p. 5296-5300.

CN: DNAL 500-N21P

PA: Other-US

PY: 1996

LA: English

CP: District-of-Columbia; USA

CO: PNASA6

IS: ISSN: 0027-8424

NT: Includes references.

PT: Article

SF: IND

DE: vegetation-. paleobotany-. paleoecology-. palynology-. pollen-. environmental-impact. man-. colonization-. islands-. biogeography-. water-erosion. fires-. plant-ecology. fire-ecology. land-use. archaeology-. deforestation-. forest-trees. botanical-composition. cook-islands.

ID: mangaia-island. human-impact.

CC: F300; K001; J800; K800

AB: A 7000-year-long sequence of environmental change during the Holocene has been reconstructed for a central Pacific island (Mangaia, Cook Islands). The research design used geomorphological and palynological methods to reconstruct vegetation history, fire regime, and erosion and depositional rates, whereas archaeological methods were used to determine prehistoric Polynesian land use and resource exploitation. Certain mid-Holocene environmental changes are putatively linked with natural phenomena such as eustatic sea-level rise and periodic El Nino-Southern Oscillation events. However, the most significant changes were initiated between 2500 and 1800 years and were directly or indirectly associated with colonization by seafaring Polynesian peoples. These human-induced effects included major forest clearance, increased erosion of volcanic hillsides and alluvial deposition in valley bottoms, significant increases in charcoal influx, extinctions of endemic terrestrial species, and the introduction of exotic species.

XAU: University of California, Berkeley, CA.

Record 111 of 123 - AGRICOLA 1992-1997

AN: CAT 10751071

UD: 9608

AU: Lentz,-Stephen-C.

CA: Rocky Mountain Forest and Range Experiment Station (Fort Collins, Colo.).

TI: Fire effects on archaeological resources, phase I : the Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico.

OT: Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico.

ST: General technical report RM ; 273.

SO: Fort Collins, Colo. : U.S. Dept. of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, [1996] ii, 103 p. : ill., maps

CN: DNAL aSD11.A42--no.273

PA: USDA

PY: 1996

LA: English

CP: Colorado; USA

NT: "March, 1996."

Includes bibliographical references (p. 98-103).

PT: Monograph; Bibliography

DE: Cultural-property,-Protection-of-New-Mexico-Jemez-Mountains.

Wildfires-New-Mexico-Jemez-Mountains. Prescribed-burning-New-Mexico-Jemez-Mountains.

Archaeology-New-Mexico-Jemez-Mountains.

CC: K110; X800

Record 112 of 123 - AGRICOLA 1992-1997

AN: IND 20428136

UD: 9411

AU: Lewis,-H.T.

TI: Management fires vs. corrective fires in northern Australia: an analogue for environmental change.

SO: Chemosphere. Oxford : Pergamon Press. Sept 1994. v. 29 (5) p. 949-963.
CN: DNAL TD172.C54
PA: Foreign
PY: 1994
LA: English
CP: England; UK
CO: CMSHAF
IS: ISSN: 0045-6535
NT: In the special issue: Preindustrial human environmental impacts: Are there lessons for global change science and policy? / edited by D.M. Kammer, K.R. Smith, A.T. Rambo, and M.A.K. Khalil.
Proceedings of a conference held September 17-19, 1993, Honolulu, Hawaii.
Includes references.
PT: Article
SF: IND
DE: vegetation-management. grasslands-. forests-. fire-effects. dry-season. ethnic-groups. archaeology-. northern-territory.
ID: monsoon-forests. aborigines-.
CC: W000; P000; K800; X800

Record 114 of 123 - AGRICOLA 1992-1997

AN: CAT 93989659
UD: 9303
AU: Scott,-Douglas-D.
TI: Don't burn that wickiup! : some considerations of cultural resources in fire management.
OT: Some considerations of cultural resources in fire management.
SO: [S.l. : Fire Operations, Montrose District, Bureau of Land Management?, 1978] 7, [3] leaves
CN: DNAL SD421.32.A165S35-1978
PA: Other-US
PY: 1978
LA: English
CP: No-place-unknown-or-undetermined
NT: Cover title.
"Prepared for Fire Operations, Montrose District, Bureau of Land Management."
"October, 1978."
Includes bibliographical references (leaves [8-10]).
PT: Monograph; Bibliography
DE: Forest-fires-Southwestern-States-Prevention-and-control.
CC: K810

Record 115 of 123 - AGRICOLA 1992-1997

AN: IND 92057099

UD: 9210
AU: Swan,-L.; Francis,-C.
TI: Fire and archaeology.
SO: Fire-Manage-Notes-U-S-Dep-Agric-For-Serv. Washington, D.C. : The Service. 1991. v. 52 (1) p. 21.
CN: DNAL 1-F766FI
PA: USDA
PY: 1991
LA: English
IS: ISSN: 0194-214X
PT: Article
DE: fire-control. forest-fires. fire-suppression. archaeological-material. ancient-monuments.
CC: K810; P300
XAU: USDA Forest Service, Shaver Lake, CA.

Record 116 of 123 - AGRICOLA 1992-1997

AN: IND 92016696
UD: 9204
AU: Fosberg,-S.; Gallagher,-J.; Lincoln,-T.; Spoerl,-P.; Wilson,-K.
TI: Research agenda for management impacts on cultural resources.
SO: Gen-Tech-Rep-RM-Rocky-Mt-For-Range-Exp-Stn-U-S-Dep-Agric-For-Serv. Fort Collins, Colo. : The Station. 1988. (164) p. 26-31.
CN: DNAL aSD11.A42
PA: USDA
PY: 1988
LA: English
IS: ISSN: 0277-5786
NT: In the series analytic: Tools to manage the past: research priorities for cultural resources management in the southwest: symposium proceedings, May 2-6, 1988, Grand Canyon, Arizona / edited by J.A. Tainter and R.H. Hamre.
Includes references.
PT: Article
DE: forest-management. cultural-heritage. research-. range-management. fire-prevention. preservation-. usa-.
CC: K200; X800
XAU: Bureau of Land Management, New Mexico State Office, Santa Fe, NM.

Record 118 of 123 - AGRICOLA (1984 - 12/91)

AN: IND 91030249
UD: 9109
AU: Swan,-L.; Francis,-C.
TI: Fire and Archaeology.
SO: Gen-Tech-Rep-PSW-U-S-Dep-Agric-For-Serv-Pac-Southwest-For-Range-Exp-Stn. Berkeley, Calif. : The Station. Mar 1989. (109) p. 156.

CN: DNAL aSD11.A325
PA: USDA
PY: 1989
LA: English
CO: XFGTB
IS: ISSN: 0092-9662
PT: Article
DE: archaeology-. fire-prevention. california-.
CC: K810
XAU: Sierra National Forest, CA.

Record 119 of 123 - AGRICOLA (1984 - 12/91)

AN: IND 91015750
UD: 9105
AU: Lissoway,-J.; Propper,-J.
TI: Effects of fire on cultural resources.
SO: Gen-Tech-Rep-RM-Rocky-Mt-For-Range-Exp-Stn-U-S-Dep-Agric-For-Serv. Fort Collins, Colo. : The Station. May 1990. (191) p. 25-30. ill.
CN: DNAL aSD11.A42
PA: USDA
PY: 1990
LA: English
IS: ISSN: 0277-5786
NT: Paper presented at a symposium on "Effects of Fire Management of Southwestern Natural Resources," Nov 15-17, 1988, Tucson, Arizona.
Includes references.
PT: Article
DE: forest-fires. fire-effects. fire-suppression. cultural-heritage. heritage-areas.
CC: K810; X800
XAU: Natural and Cultural Resources Management of Bandelier National Monument, Mexico.

Record 121 of 123 - AGRICOLA (1984 - 12/91)

AN: IND 88022264
UD: 8809
AU: Hunter,-J.E.
TI: Prescribed burning for cultural resources.
SO: Fire-Manage-Notes-U-S-D-A-For-Serv. Washington, D.C. : The Service. 1988. v. 49 (2) p. 8-9.
CN: DNAL 1-F766FI
PA: USDA
PY: 1988
LA: English
IS: ISSN: 0194-214X
NT: Includes references.

PT: Article
DE: forest-fires. prescribed-burning. corylus-cornuta. prescribed-burning.
ID: xerophyllum-tenax.
CC: K810; K110; K590

Record 122 of 123 - AGRICOLA (1984 - 12/91)

AN: IND 85076384
UD: 8512
AU: Roberts,-J.E.
TI: Protection of archaeological sites and special areas during prescribed burning.
SO: Fire-Manage-Notes-U-S-D-A-For-Serv. Washington, D.C. : The Service. 1985. v. 46 (3) p. 9-10. ill.
CN: DNAL 1-F766FI
PA: USDA
PY: 1985
LA: English
PT: Article
DE: prescribed-burning. archaeological-material. protection-. fire-suppression.
CC: K810; K110

Record 123 of 123 - AGRICOLA (1984 - 12/91)

AN: IND 85025034
UD: 8506
AU: Anderson,-B.A.
TI: Archeological considerations for park and wilderness fire management planning.
SO: U-S-D-A-For-Serv-Gen-Tech-Rep-INT-Intermt-For-Range-Exp-Stn. Ogden, Utah : The Station. Apr 1985. (182) p. 145-148.
CN: DNAL aSD11.A48
PA: USDA
PY: 1985
LA: English
CO: XGTIA
IS: ISSN: 0363-6186
NT: Paper presented at the "Symposium and Workshop on Wilderness Fire," Nov. 15/18, 1983, Missoula, Montana.
Includes references.
PT: Article
DE: forest-fires. fire-control. archaeology-. parks-. wilderness-.
CC: K810

12/19/2000 Kirk Halford
Search of DIALOG databases
5 citations

Search for keywords: **fire effects and archaeology**

1.)

DIALOG(R)File 8: Ei Compendex(R)

Title: **EFFECTS OF LA MESA FIRE ON BANDELIER'S CULTURAL RESOURCES.**

Author: Traylor, Diane

Conference Title: La Mesa Fire Symposium.

Conference Location: Los Alamos, NM, USA Conference Date: 19811006

Sponsor: Los Alamos Natl Lab, Los Alamos Natl Environmental Research Park, Los Alamos, NM, USA; Natl Park Service, Southwest Region, Santa Fe, NM, USA; Southwest Fire Council, USA

E.I. Conference No.: 05036

Source: Los Alamos National Laboratory (Report) LA 9236-NERP. Publ by Los Alamos Natl Lab, Los Alamos, NM, USA. Available from NTIS, Springfield, Va, USA p 97-102

Publication Year: 1984

CODEN: LANLDK

Language: English

Document Type: PA; (Conference Paper)

Journal Announcement: 8411

Descriptors: *FORESTRY--*Fire Protection

Identifiers: FOREST FIRES; LA MESA FIRE; BANDELIER NATIONAL MONUMENT; ARCHEOLOGICAL SITES; FIRE DAMAGE TO CULTURAL RESOURCES; HEAT DAMAGE TO ARTIFACTS; FIRE ECOLOGY

Classification Codes:

821 (Agricultural Equipment & Methods); 914 (Safety Engineering)

82 (AGRICULTURE & FOOD TECHNOLOGY); 91 (ENGINEERING MANAGEMENT)

Search for keywords: **forest fire/prescribed burn and archaeology**

2).

DIALOG(R)File 6: NTIS

NTIS Accession Number: PB91-123398

Impacts of Prescribed Burning on Archeological and Biological Resources of the Knife River Indian Villages NHS

(Final rept. 23 May 88-1 Jul 89)

Sayler, R. D. ; Seabloom, R. W. ; Ahler, S. A. ; Picha, P. R. ; Seabloom, N. R. North Dakota Univ., Grand Forks.

Corp. Source Codes: 013173000

Sponsor: National Park Service, Washington, DC.

Jul 89 134p

Languages: English

Journal Announcement: GRAI9105

Sponsored by National Park Service, Washington, DC.

Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.

NTIS Prices: PC A07/MF A01

Country of Publication: United States

The Knife River Indian Villages National Historic Site (KNRI) was established in 1974 for the purpose of insuring the preservation, interpretation, and research of unique historical and archeological resources associated with the Plains Indian and various cultural-historic periods (Hellickson-Key 1984). The park harbors evidence of several centuries of human activity, especially post ca. 1750, and is noted for its earthlodge village sites, historical associations with Lewis and Clark and other Euro-American explorers, as well as being a site of the agricultural phase of Plains Indian development. Cultural resource studies have revealed a wealth of archeological artifacts and historical sites within the 520 ha of KNRI. The report describes results of a research program designed to experimentally test major impacts of prairie fires on archeological materials common to KNRI. We also review known impacts of burning programs on both artifacts and selected plant species common to KNRI. Based on these results, we present a series of technical management recommendations to: (1) preserve the valuable archeological resources of KNRI, (2) mitigate potentially negative impacts of prescribed burning programs, and (3) utilize safe fire management procedures to enhance the plant and animal communities of KNRI.

Descriptors: *Archaeology; *Fires; Management planning; Parks; Forecasting; Maintenance; American Indians

Identifiers: *Knife River Indian Villages National Historic Site; *Historic preservation; *Prescribed burning; Cultural resources; Ecosystems; Plant communities; Artifacts; NTISDIPSDH

Section Headings: 92D (Behavior and Society--Education, Law, and Humanities)

3.)

DIALOG(R)File 111:TGG Natl.Newspaper Index(SM)

After a forest fire, it's the thrill of the hunt for this Forest-Service archaeologist.

(Features)(Ideas)

Christian Science Monitor, 18

Sept 14, 2000

ISSN: 0882-7729 LANGUAGE: English RECORD TYPE: Citation

Search for keywords: **prescribed burn/forest fire and cultural resources**

4.)

DIALOG(R)File 6:NTIS

NTIS Accession Number: PB81-217713/XAB

Flag Prairie Validation Prescribed Control Burn Cultural Resource Reconnaissance

(Final rept. 20-23 Oct 80)

Zilverberg, G.

Malheur National Forest, John Day, OR.

Corp. Source Codes: 072355000

Report No.: MNF/646-81/014

Jan 81 47p

Languages: English

Journal Announcement: GRAI8122

Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.

NTIS Prices: PC A03/MF A01

Country of Publication: United States

To comply with Federal rules and regulations concerning protection of cultural resources on public land, a cultural resource reconnaissance was conducted over the Flag Prairie Range Validation Prescribed Control Burn project, an area of 250 acres, during October 1980. The project area is located in the Northern Great Basin of east-central Oregon. The reconnaissance resulted in the location and identification of one prehistoric and one isolated-find properties.

Descriptors: *Archaeology; History; Sites; Public land; Surveys; Protection; Mountains; Fossils; Environmental impacts; Subsurface investigations; Ethnology; Field tests; Oregon; Maps; Evaluation

Identifiers: *Historic preservation; *Prescribed burning; Grant County(Oregon); Malheur National Forest; Points; NTISAGFSMN

Section Headings: 92D (Behavior and Society--Education, Law, and Humanities); 48D (Natural Resources and Earth Sciences--Forestry)

5.)

DIALOG(R)File 6:NTIS

NTIS Accession Number: PB91-137448

1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument

Traylor, D. ; Hubbell, L. ; Wood, N. ; Fiedler, B.

National Park Service, Santa Fe, NM. Southwest Cultural Resources Center.

Corp. Source Codes: 022304002

Report No.: PP-28

Jan 90 225p

Languages: English

Journal Announcement: GRAI9108

Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.

NTIS Prices: PC A10/MF A02

Country of Publication: United States

The La Mesa Fire occurred in 1977, and the report was essentially

completed two year later. With 90 percent of the editorial work completed, funding apparently ran out, the staff dispersed, and the work was put on the shelf. In 1990, the Southwest Region's Branch of Cultural Resources Management undertook the task of reviving and publishing the study in its original form. Topics covered include: A Survey of Fire-Impacted Areas in Bandelier National Monument; Excavations and Sampling of Four Sites Within the La Mesa Burn; The Impact of Fire and Fire Suppression On Cultural Resources in Bandelier National Monument; Recommendations For Future Actions During Forest Fires In Areas Containing Cultural Resources; and References Cited.

Descriptors: *Archaeology; *Fire damage; *Forest fires; *Cultural resources; Fire fighting; Site surveys; La Mesa Forest; Prehistoric cultures; Artifacts; Architecture

Identifiers: Bandelier National Monument; NTISDIPSDH

Section Headings: 48D (Natural Resources and Earth Sciences--Forestry); 92D (Behavior and Society--Education, Law, and Humanities)

BLM Utah RAC Subgroup Report on Fire Rehabilitation

12/14/2000 Kirk Halford

Search of the internet for information on fire effects AND archeology:

2 items

1.) <http://www.ut.blm.gov/rehabsub.html#5> - Cultural

BLM Utah - Fire Rehabilitation Program

RAC Subgroup Report on Fire Rehabilitation
by
James E. Bowns, Subgroup Chair

PREAMBLE

In the last five years, as a result of wildfires, there has been a dramatic increase in the number of acres burned in Utah. On lands administered by the Bureau of Land Management (BLM) wildfires increased from 4,549 acres in 1991, to 308, 457 acres in 1996 (BLM Facts & Figures for Utah). The 1996 fires resulted in the loss of perennial vegetation over large areas of arid and semi-arid ecosystems in Utah.

This increase is the result of several factors including low precipitation, extremely low vegetation fuel moisture, past policies of controlling all wildfires, the lack of perennial vegetation, and the invasion of cheatgrass and other introduced annual weedy species that are highly flammable.

Rehabilitation of these lands became a public issue when various groups disagreed on whether treatment methods disturbed cultural resource values or the burned site required treatment. Several issues were discussed with the Resource Advisory Council (RAC), who then decided to form a Subgroup to look into the matter. The following issues were considered by the Subgroup.

Issue #1 - Vegetative Rehabilitation and Management of a Burned Area

Issue #2 - Knowledge and Experience

Issue #3 - Methodology

Issue #4 - Native Verses Non-native Seed

Issue #5 - Cultural Resource Inventories

Issue #6 - Cultural Resource Significance

Issue #7 - Native American Coordination and Consultation

Issue #8 - Treatment of Cultural Resources

ISSUE #1 - Vegetative Rehabilitation and Management of a Burned Area

Is it better to seed the area or to allow it to recover naturally through the successional process?

Since fire is a natural phenomenon and component of ecosystems, the first questions considered by the RAC Subgroup were "When considering soil, water, plant and animal resources, should burned areas be allowed to respond naturally or is fire rehabilitation justified? Has the invasion of cheatgrass and other non-native species altered the recovery process?"

ANALYSIS

Utah and other areas of the West have a diversity of ecosystems that respond differently to burning. Some ecosystems require fire for their maintenance (i.e. chaparral) and others may be very sensitive to burning. How ecosystems respond is determined by when the fire occurs (spring, mid-summer, fall), the intensity of the fire (which is dependent upon fuel loads, relative humidity, wind, air temperature), and the composition of the existing plant community, including weeds, at the time of the fire.

How areas recover from burning is largely dependent upon what native or naturalized plant community is in place at the time the fire occurs. If a sufficient understory of perennial grasses, forbs and shrubs is present prior to burning then the plant communities normally recover without reseeding. However, in many situations the herbaceous or shrub communities have been removed by competition from pinyon-juniper communities (P-J) or sagebrush encroachment, overgrazing by livestock and big game, weed infestations, or climatic changes. Under these conditions sufficient native plants are not present to protect the site, or facilitate secondary successional recovery processes and will require seeding of desired species. Fire may be used in such areas as an opportunity to reestablish natural diversity.

Soil, Water, Vegetation

The overriding concern of fire rehabilitation is to conserve the soil and maintain the site. It is well recognized that management goals must be designed to protect the three basic resources of soil, water and vegetation. It is also generally accepted that it requires centuries or millennia to develop an inch of topsoil in arid regions. In addition, recovery of native communities may also require extended periods of time to fully develop. Invasion of weeds can greatly inhibit this process and alter the eventual composition over extensive areas.

Annual plants grow erratically from year to year and are less capable of protecting the soil, throughout the year. Lack of suitable and stable plant cover results in increased rates of wind and water erosion, and a depletion of soil microflora and fauna that are prerequisite to healthy soils and plants. Adapted perennials, with more diverse rooting capabilities, are better able to stabilize soils, retard the frequency and intensity of fire, compete with undesirable species and continue the soil building process. Seedings, consisting of perennial grasses and shrubs, provide a more stable and effective cover than annual weeds. In addition, these seedings restrict weed invasion, and reduce the incidence and size of fires.

Weed Invasion

Weed suppression and control is now a national issue and is receiving attention from the highest levels of government down to the county, city, and individual land owner levels. In many P-J sites the exotic or introduced alien cheatgrass is the pioneer species that occupies the site. In many situations, this plant and other weeds have invaded P-J sites prior to burning. As these weed infested sites burn, the weeds flourish and become more dominant. Cheatgrass is a particularly aggressive winter annual that quickly dominates new disturbances and effectively out-competes seedlings of native species. Consequently natural succession or recovery is delayed, significantly altered, or stopped.

Cheatgrass is also extremely flammable and it considerably alters the intensity and frequency of fires. Fire frequency was originally on the order of every 70 to 100 years or longer. Once these sites are occupied by cheatgrass, fire frequency has changed to every 3-5 years, or at least to more frequent intervals. In addition to increasing fire frequency, cheatgrass has also had an affect on the number of acres consumed by fire. Large contiguous areas are now dominated by this highly flammable weed. When a fire starts on a dry cheatgrass site, the area is quickly consumed. The spread of the fire is rapid and the burned area becomes extensive. If these burned areas are not treated, cheatgrass and other weeds will invade as well, ever expanding their domination of the landscape. Cheatgrass monocultures are now established in extensive portions of the Great Basin, Snake River Plains, Northern & Central Nevada, and the Pacific Northwest. Other exotic annual grasses occupy areas throughout the southwest, including southern Utah, southern Nevada and southern California.

Sites dominated by cheatgrass may have crossed a threshold and succession may not proceed toward the original community or succession will be very slow. This situation that mandates reseeding with adapted species to stabilize the site, prevent soil erosion and prevent the establishment of cheatgrass and other weeds.

On cheatgrass dominated sites there is a much greater opportunity for other secondary weed species to invade and contribute to the degradation of the site. These weed species include, but are not limited to, the Knapweeds (several species), annual mustards (several genera), Medusa-head rye and other annual grasses, scotch, musk and other thistles, skeleton weed, and tumble weed. These species can gain a foothold on cheatgrass sites and eradication becomes extremely difficult or impossible.

Weed invasion can best be prevented or slowed by the reestablishment of perennial communities. Seeding of adapted and desired perennials is most important, but weed control may also be a necessary adjunct to seeding.

Healthy plant communities must maintain their resistance to and resilience from uses and disturbances such as grazing, fire, drought, insects, etc. Plant communities that become dominated by annuals such as cheatgrass lose that ability. When this occurs, range sites are no longer capable of producing diverse plant and animal populations.

SUBGROUP RECOMMENDATIONS

The main objective of fire rehabilitation must be the protection of the basic resources of soil, plants, and water. If an adequate perennial plant community is in place at the time of burning the

normal succession process should allow for natural recovery. When a sufficient understory is lacking there will usually be a need for seeding.

The establishment of a perennial community is essential for preventing the establishment of exotic annual weeds. It is critical that seeding be completed within the window of opportunity or annuals will likely dominate the site and fire frequency and intensity will be drastically altered. It is imperative that primary weeds, like cheatgrass and other secondary weeds not invade and cause further site degradation.

ISSUE #2 - Knowledge and Experience

The RAC Subgroup was asked to evaluate whether the BLM employees on-the-ground had the knowledge and experience necessary to be given, or to continue, the task of rehabilitating burned areas.

ANALYSIS

It is recognized that fire management expertise can be spread very thin during catastrophic fires such as those experienced in 1996, so additional and upgraded training and certification of reclamation specialists should be a top priority.

It was suggested that University programs may have become overzealous in teaching range management philosophy and are not effectively teaching the practical aspects of soil, water, plant, and animal management. Emphasis should be placed on experience and practical knowledge, as well as, the dissemination of information.

Some BLM managers, especially those in areas which experience frequent fires, have the knowledge and experience to conduct effective rehabilitation projects. Others may lack experience (in areas where fire is not frequent), or not be current in plant material availability, agronomic practices and the use of animals to manipulate vegetation. These basic skills are not as prevalent in the land management agencies, or society in general, as they once were. The Subgroup suggests that deficiencies in these areas could easily result in a lack of public confidence and support. Also there is concern that political correctness and special interest pressure may be substituted for proper resource management decisions.

The Subgroup recommends that a core of specialists receive regular training in the area of plant species selection which includes adaptations to specific sites, seed characteristics, etc., of native and exotic species. There should also be a greater understanding of methods of seeding, seedbed ecology, site preparation and seeding equipment, ecological site delineation, range improvement techniques and equipment, and GIS mapping. BLM should develop or support training and certification to help develop, inspect, direct, approve and monitor restoration projects.

Considerable knowledge is available on individual plant communities, and species. This current information should be assembled and made available to land managers. At least one subgroup member felt this information is poorly assembled and not updated, and managers fail to use what data is available.

A contract has been awarded to Utah State University to gather data relative to fire rehabilitation. Results of this effort will be distributed to all employees involved in the Emergency Fire Rehabilitation program. See the folio database on Fire Effects on Rangelands in the Great Basin and Colorado Plateau Regions of Utah: An Annotated Bibliography.

A national BLM Fire Rehabilitation Workshop was held in Salt Lake City on October 21-23, 1997. Agenda items included: update of VEGSPEC rehabilitation database; effects of fire & rehabilitation on microbiotic crust; modifications of the rangeland drill to improve seed distribution; seeding equipment availability & ordering; seed requirements & ordering through the regional seed warehouse; rehabilitation studies on Colorado fires; aerial seeding & chaining/harrowing on the Foothills Fire, Idaho; rehabilitation monitoring needs, strategies and status; contracting; Utah large scale wildfire & rehabilitation problems, successes and failures; weed invasion and treatment following wildfire; use of the herbicide 'Oust' before seeding; new technologies for rehabilitation; Wyoming sagebrush reseeding; forage Kochia; EFR handbook presentation on changes; and Clean Water Act compliance. A panel discussed: Native Versus Non-Native species in EFR Program (panel representatives from research, conservation group, livestock industry, academia, land management agency, etc.).

The Subgroup found that BLM is currently updating fire restoration procedures, direction and guidelines. Fire management will be included in the land use planning process prior to burning.

SUBGROUP RECOMMENDATIONS

The Subgroup recommends that funding and resources should be provided to better evaluate and monitor rehabilitation projects. BLM direction has recently been changed to allow funding for monitoring rehabilitated areas for up to three years and be charged to the approved rehabilitation plan.

Expertise in rehabilitation is often spread thin, so it is necessary to provide additional upgraded training and certification. Emphasis should be placed on practical knowledge and experience. There is a need for regular training in the selection of plant species adapted to specific sites, methods of seeding, ecological site evaluations, etc.

Current information should be assembled, updated and made available to field personnel. Managers should be encouraged to attend symposia and workshops specifically related to this subject.

Fire management should be included in the land use planning process and monitoring should be a major part of rehabilitation plans.

ISSUE #3 - Methodology

The Subgroup was asked to consider if BLM is using the best science available when rehabilitating areas burned by wildfires. Different treatment methods were evaluated at several sites.

ANALYSIS

Rehabilitation following wildfires may involve the following: using seed mixtures adapted to the site; drilling seed; broadcasting seed from aircraft without covering it; broadcasting seed followed by dragging a chain to cover the seed; construction of waterbars to reduce erosion; fencing, to keep livestock off rehabilitated areas until plants have established; and, monitoring to evaluate successes or failures.

Seeds of all species require specific seedbed conditions in order to germinate and develop healthy seedlings. Seeds of most species must be covered in order to be adequately stratified, break dormancy, support germination and assure seedling establishment.

Drilling seed

The standard rangeland drill that has been used for the past 50 years has not been upgraded with features that are available on some newer models used in agriculture. Some newer drills have separate seed boxes that are equipped with depth control devices that can be adjusted to the desired seeding rate and depth for each species used. Although such seed drills are available, they are expensive and are not generally in circulation. Upgrading of equipment is expensive and will require special emphasis from management and research agencies. Since newer drills are not available, BLMers feel fortunate to have access to the old drills when a project is done.

Drilling seed has been found to be highly effective when soil, slope, and obstacles are not limiting.

Broadcast seeding, without covering the seed

Few species can establish if placed and left uncovered on arid or semi-arid soils that dry quickly and do not remain moist for extended periods. Visits to sites that were aerial seeded, without any seed coverage, confirmed that this practice was not acceptable on these soils and where soil erosion is a factor. Very little of the uncovered seed had germinated, and what did germinate was not sufficient to protect the soil. The Subgroup found that it is not advisable to broadcast seeds upon the soil surface without some means of covering the seeds. On the other hand, great care should be taken to assure that seed is not placed too deep in the soil. Most grass seed should not be planted deeper than ½ inch.

Broadcast seed, followed by covering the seed

It was found that dragging a chain over the burned and seeded area adequately covers seed. Using a chain to cover the seed allows for surface tillage to be easily regulated. This can be accomplished by using different sized chains, use and positioning of swivels, operational speed, configuration of the chain or using a modified chain such as the "Ely" chain or "Dixie" sager. This treatment is especially useful on harsh, steep slopes where seedling establishment is critical to prevent erosion.

This method has versatility for varying surface tillage by: using different sizes of chains; the use and positioning of swivels; varying operation speed and chain configuration; and, using a smooth, "Ely" chain, or "Dixie sager."

A distinction must be made between the chaining of live trees and covering seed on areas where trees and shrubs have been killed by fire.

Broadcast seeding uses a higher rate of seed, so there is a better chance that each species will find its ultimate niche. Most members of the Subgroup found that rolling a chain over the seed, created adequate seedbeds for mixtures of seed. And they concluded that covering the seed in this manner may be the only method that can achieve the objectives in a cost effective and practical manner when vast acreages are to be seeded. There are many areas of BLM administered land that is too rough or too steep for drilling. An invited Scientist who adamantly opposes chaining of live trees, agreed that covering the seed with a chain is an acceptable and effective method of rehabilitation where trees and shrubs have been killed by fire.

Alternative treatments

One alternative treatment suggested to BLM is hand cutting of trees and distributing tree limbs on the soil surface. Cutting dead or burned tree skeletons is very labor intensive and placing these on the soil surface does not provide an adequate seedbed and does not cover the seeds. The Subgroup felt this practice has limited application.

Another suggested alternative treatment is using livestock to trample the seed into the ground. While this may be effective in small areas, the disadvantages discussed include: the size of the burned area needing treatment; availability and control of the livestock; lack of food available for the livestock on the burned sites; and the ash turning the animals (wool) black. This was discussed among various groups, but not included in the written response to the 20 questions.

SUBGROUP RECOMMENDATIONS

Rehabilitation of wildfires should include: the use of suitable seed mixtures; drilling seed; broadcasting seed without covering it; broadcasting seed and dragging a chain to cover the seed; construction of erosion control structures; fencing for managing livestock; and monitoring.

BLM should purchase and have available the state of the art range drills. These new models provide separate seed boxes for a variety of plant seed. Control of dispersal rates and depth of planting are advantages of this new equipment.

Seeds of most species must be covered in order to assure establishment. Dragging a chain over burned and seeded areas is a suitable technique for covering seed. Chains are useful on rocky soils, harsh or steep slopes where plant establishment is critical for controlling erosion. Using the chain can achieve the objectives in a cost effective and practical manner when large acreages are to be rehabilitated. Alternative methods to using a chain are often too labor intensive, expensive or impractical for a variety of reasons.

ISSUE #4 - Native Verses Non-native Seed

The use of and distinction between native and non-native species is currently a very contentious issue.

Therefore it was addressed by the Subgroup.

ANALYSIS

The main objective of fire rehabilitation is to establish an ecologically sound and functioning perennial plant community. It is therefore important to choose species for their ease of establishment, seedling vigor, and persistence. Emphasis should be placed on plant materials that are best adapted and capable of protecting the basic soil resource.

Considering the established presence of non-natives such as cheatgrass and State listed noxious weeds, keeping a site "natural" seems to be a moot point. Subgroup members pointed out that many dryland and irrigated species currently grown in North America have been introduced from foreign countries in the last one hundred and fifty years.

As a general rule, areas of higher moisture and elevation, deep soils, moderate conditions, and conservative grazing use, respond well to seeding native species. Arid, harsh sites common to BLM lands impacted by heavy domestic and wild animal use, weed invasion and other disturbances may not respond favorably to seeding natives. There are introduced species, and cultivars developed by the USDA Agricultural Research Service and Universities, that are vigorous and establish good stands on harsh sites. Native species that establish well at higher latitudes may not be as successful at our southern latitudes.

The Subgroup suggests that BLM, in cooperation with the seed industry, aggressively adopt a program to develop, produce and use native species on sites where they are adapted and can be expected to thrive. After identifying key native species, seed collectors and marketing companies should be encouraged to produce the seed.

Until more native seed becomes available BLM should use a mixture of native and introduced species. The introduced species can act as a nurse crop, holding the soil in place, and controlling weed invasion, until the native species can again become established.

BLM maintains a seed warehouse in Boise where seed is prepurchased and stock-piled each year before the fire season. In a "normal" fire year, this seed is usually adequate for most of Utah's seed needs. In 1996 large quantities of additional seed were needed, so it was necessary to go out for bids. Adequate amounts of native seed were not available and substitutions had to be made.

The Subgroup recognizes that cost should be a consideration in the selection of plant materials, especially if there is a trade off between total acres treated versus a highly expensive native seed mix.

At higher elevations with more precipitation, deeper, better developed soils, and other more desirable conditions, native species respond well. Arid, harsh sites typical of BLM lands with heavy ungulate use, weed invasion or other disturbances may not be as suitable for native species. On the other hand, selected species and cultivars establish on these harsh sites. Also, native species that establish well at northern latitudes may not be as successful as southern latitudes.

SUBGROUP RECOMMENDATIONS

The major concern must be to maintain ecologically functioning perennial plant communities. Seeded species should be selected for ease of establishment, seedling vigor and persistence in the community. Emphasis should be placed on those plants that are best suited for the site in question. Species selection must be made at the local level by qualified personnel on a site specific basis.

A pre-inventory of expected needs and a proactive program of encouraging the collection and storage of native seed should result in quantities adequate for a "normal" fire year at reasonable cost.

Guideline #5 of Utah's Standards for Rangeland Health and Guidelines for Grazing Management (May 1997) addresses this issue and states, "The use and perpetuation of native species will be emphasized. However, when restoring or rehabilitating disturbed or degraded rangelands non-intrusive, non-native plant species are appropriate for use where native species (a) are not available, (b) are not economically feasible, (c) cannot achieve ecological objectives as well as non-native species, and/or (d) cannot compete with already established non-native species."

ISSUE #5 - Cultural Resource Inventories

In accordance with the requirements of Section 106 of the National Historic Preservation Act of 1966 (NHPA), federal agencies must make a reasonable and good faith effort to identify any cultural resources which may be subject to impact from the proposed action and which may be eligible for inclusion on the National Register of Historic Places. The potential impact of the proposed action must be considered by the federal agency official prior to making a decision which could impact those resources. Given the limited windows of opportunity to conduct effective fire rehabilitation efforts, cultural inventories must be compressed into a very short time frame: after the fires are extinguished but prior to rehabilitation. What opportunities exist to streamline the inventory process?

ANALYSIS

As a direct result of the 1996 wildfire season, considerable informal discussion and debate has occurred around the nation on this subject. Formal discussion of this issue has resulted in recommendations from the Utah Professional Archaeological Council, Mr. Mark Stuart representing the Utah Resource Advisory Council, and others. While the several recommendations vary in detail, there seems to be consensus that opportunities to streamline exist in two major areas:

1) Field methodologies should be streamlined to allow more efficient utilization of staff resources, whether these are in-house personnel, volunteers, or contractors. Location, external site boundaries, and a brief characterization of the resource should be emphasized.

2) There has also been discussion concerning the use of available human resources - including volunteers and contractors. All of these choices have benefits and drawbacks based on start-up time, cost, and availability. Use of each or all should be considered on a case-by-case basis. Relatively small acreages proposed for rehabilitation can be inventoried using in-house personnel and well trained volunteers. As fire size increases, or as the number of fires subject to rehabilitation increases, BLM should increasingly rely on contract efforts. Start-up time for contract work can be minimized by preparation of basic contract packages prior to the fire season.

It is important to reiterate that while there is no legal or regulatory definition of an adequate inventory, the NHPA anticipates that inventory will be sufficient to locate properties that may be eligible for inclusion on the National Register. BLM policy is to conduct Class III, 100% inventory where circumstances suggest that complete physical inventory is needed to locate all eligible properties. As an inventory database emerges through time, it may be possible to determine that certain areas, usually defined by landform or environmental conditions, exhibit a paucity of eligible properties; once these areas are identified, inventory standards may either be reduced or waived in consultation with the State Historic Preservation Officer (SHPO). Sampling, or Class II probabilistic inventory, may be appropriate in limited circumstances.

SUBGROUP RECOMMENDATIONS

A reasonable and good faith effort must be made to identify any cultural resources that may be impacted by the proposed action and which may be eligible for inclusion on the National Register of Historic Places. The potential impact of fire rehabilitation must be considered.

Field methodologies should be streamlined. Location, external site boundaries, and a brief characterization should be emphasized.

The use of all available human resources provides choices that have benefits and drawbacks. Use of each should be considered on a case-by-case basis. Small acreages can be handled with in-house personnel and qualified volunteers. On large fires, BLM should rely on contract efforts. More reliance should be made on pre-fire contract packages.

It may be possible to determine that certain areas, usually defined by landform or environmental condition, exhibit a paucity of eligible properties. Once these areas are identified, inventory standards may be reduced or waived.

Sampling, or class II probabilistic inventory, may be appropriate in limited circumstances.

ISSUE #6 - Cultural Resource Significance

Significance of archaeological and historical resources found on the public lands subject to fire rehabilitation efforts has been the focal point of considerable debate and discussion. What constitutes significance? While this is clearly an important issue, it must be understood that for the purposes of agency compliance with Section 106 of the National Historic Preservation Act, certain legal definitions exist and must be employed.

In the context of the NHPA, a cultural resource or site or property has significance if it is eligible for inclusion on the National Register, and by definition a significant site is eligible for inclusion on the National Register. For our purposes, the two terms, eligible and significant, are interchangeable. The National Register criteria for evaluation are reproduced below from federal regulations at 36 CAR Part 60.4:

"The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and

(a) that are associated with events that have made a significant contribution to the broad patterns of our history; or

(b) that are associated with the lives of persons significant in our past; or

(c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

(d) that have yielded, or may be likely to yield, information important in prehistory or history.

Prior to authorizing an action which may result in an effect to any cultural resource, the criteria for evaluation must be applied to all of the resources located during the identification (inventory) stage of work. At a minimum, determinations of eligibility for inclusion on the National Register must be reached in consultation between the federal agency and the State Historic Preservation Officer. In the event of disagreement between the parties to consultation, formal determinations may be deferred to the Keeper of the Register in Washington, DC. A great deal of effort is required to complete this consultation

process. A narrative report describing the inventories and the results of the inventories must be prepared; a formal site record must be prepared, with detailed information, for each cultural resource site located during the inventory. The criteria for evaluation must be applied to each resource, discussed in the report, with the agency determinations for eligibility. As a rule of thumb, it takes at least as many days to write this type of report as it does to complete the physical inventory.

It is important to note that cultural efforts conducted after the 1995 and 1996 wildfire seasons on BLM lands in Utah were streamlined considerably. To avoid a protracted effort to prepare reports and site eligibility evaluations on hundreds of sites, BLM and SHPO agreed to a flag-and-avoid procedure. Sites were recorded in the field and flagged for avoidance. As soon as the physical inventories were completed, authorization to commence rehabilitation work (drill

seeding or chaining) was issued; reports describing the inventories were to be submitted at a later date. It was necessary to avoid all of the cultural sites, since there was no time for consultation with SHPO on eligibility.

Avoidance (flagging) procedures present another problem which has yet to be resolved. As has been discussed at some length, flagging also serves to identify the sites for possible vandalism. Another drawback to avoidance procedures is the simple fact that avoided sites are not effectively re-seeded; these sites may develop cheat grass and other noxious weeds, and may be more prone to surface erosion, and these sites become obvious because of the cheatgrass. Anecdotal information available from the 1996-97 rehabilitation efforts suggests that in some areas, at least, erosion of archaeological sites in avoidance areas has resulted in site damage.

One option would be to pursue chaining and/or drilling over as many sites as possible to limit the acreage available to cheat grass, to minimize the number of sites exposed to erosion, and to minimize the exposure of sites to vandalism. Archaeologists are not uniform in their views, however, and an opposing viewpoint exists which suggests that rehabilitation areas should be minimized to the extent possible, that larger areas should be in avoidance zones where the sites would blend in to the surroundings and not be keyed out by close flagging. Some individuals argue that chaining and drill seeding are not necessary and that the burned areas will recover with no seed bed preparation or soil cover. These factions argue that the rehabilitation efforts cause more damage to the environment, and an unjustifiable threat to the cultural resources.

There are no easy answers. Recommendations from BLM professional staff, the Utah Professional Archaeological Council, Mr. Mark Stuart of the Resource Advisory Council and others have suggested that additional efficiencies could be gained by investing in research to determine in advance what types of cultural sites might be considered eligible, and which ineligible, for inclusion on the National Register. If a series of clear, well understood thresholds for eligibility could be defined for a region or series of regions subject to wildfire, it might be possible to develop an agreement where field crews would be able to assess eligibility in the field, and to determine which sites should be protected. In turn, fewer avoidance areas on any rehabilitation project would increase the acreage available for re-seeding, and reduce the human efforts necessary to assure site avoidance, reduce erosion on sites, etcetera.

An additional benefit to accrue from research into eligibility issues would be the opportunity to apply the best available science in a careful, thoughtful manner. Resource management decisions which balance the needs of cultural resource protection and preservation against the needs of natural resource conservation could be given more consideration, before the fire season and not as a result of the fire season.

Avoidance (flagging) procedures present problems because it serves to identify sites for possible vandalism. Avoided sites are not effectively seeded, and the sites may revert to noxious weeds and be more prone to erosion.

One option is to pursue chaining and/or drilling over as many sites as possible to limit the acreage susceptible to cheatgrass and minimize erosion and exposure to vandalism.

Another option is to minimize rehabilitation areas so that sites would blend into the surroundings and not be made obvious by flagging.

SUBGROUP RECOMMENDATIONS

Legally, a cultural resource or site or property has significance if it is eligible for inclusion on the National Register. At a minimum, determination of eligibility must be reached in consultation between the federal agency and SHPO. A narrative report must be prepared, and a site record must be prepared for each resource.

Efficiencies could be gained by determining in advance what cultural sites might be considered eligible. This process will help balance the needs of cultural resource protection and preservation against the needs of natural resource conservation.

ISSUE #7 - Native American Coordination and Consultation

Despite BLM efforts to coordinate and/or consult with the appropriate Indian tribes in September and October of 1996, serious Native American concerns surfaced in spring of 1997, with a major effect on the outcome of the BLM rehabilitation effort. What is the role of the Native American people as regards undertakings, or proposed actions, on public lands?

ANALYSIS

Several laws provide clear statutory guidance in this area. The National Environmental Policy Act of 1969 (NEPA), the Federal Land Policy Management Act of 1976 (FLPMA), the American Indian Religious Freedom Act of 1978 (AIRFA), and the National Historic Preservation Act of 1966 (as amended, NHPA) in concert require BLM to coordinate and to consult with tribes on the full range of land management activities from developing land use plans, through the environmental analysis process, up to and including the land-use decision making process, to determine whether or not agency actions will impact tribal values, religion, culture and or other interests.

Prior to making a decision which may affect tribal interests, BLM has an obligation to contact tribes, coordinate with tribes, and to consult with tribes where appropriate, on the nature and potential impacts of proposed actions, and to consider tribal input, views, and concerns in the decision making process. Additionally, the relationship of the United States government to sovereign Indian tribes is a government-to-government relationship which requires exercise of due respect to the needs of each tribe as regards their form of government and communication needs.

Coordination and consultation with tribal entities is often a time consuming process; the process takes longer when matters of cultural importance are being considered by the tribe(s). Federal agencies like BLM occasionally are pressed to act quickly to resolve resource conflicts, as with the emergency fire rehabilitation actions. Moving quickly to issue a decision on any subject of deep concern to tribal interests, without taking tribal concerns into account, will lead to miscommunication, confusion, and conflict.

Establishing and maintaining a government-to-government relationship based on credibility and trust is the first step in assuring that an appropriate role is available to the Native American community. The nature of the role that tribal entities and Native American people will exercise must be defined by the tribes and by the concerned individuals. The agency obligation is to communicate, coordinate, and to consult in good faith. As an example, it may be appropriate for tribal members to participate with BLM in a wide range of activities, where appropriate and at the discretion of the tribe. Conversely, the tribe(s) may choose not to participate. There are various avenues for improving relationships with tribes and for making the coordination/consultation process more effective and positive. BLM should learn more about tribal concerns, beliefs, and needs, and how those tribal interests are affected by BLM land management. All answers revolve around better communication.

SUBGROUP RECOMMENDATIONS

MOUs and cooperative agreements could be developed to anticipate resource activities, including emergency fire rehabilitation. BLM is legally mandated to coordinate and consult with Native Americans, on the full range of land management activities, to determine whether or not agency actions will impact tribal values, religion, culture, and/or other interests.

BLM must contact, coordinate and consult with tribes on the nature and potential impacts of proposed actions and consider tribal input, views, and concerns. This government-to-government relationship requires exercise of due respect to the needs of each tribe and must be based on credibility and trust. BLM should learn more about tribal concerns, beliefs, needs, and how tribal interests are affected by land management decisions.

ISSUE #8 - Treatment of Cultural Resources

There has been discussion on the appropriate treatment of cultural resources once discovered, in effect, should sites be avoided, should they be seeded, chained or drilled to prevent erosion, and should some sites be treated differently than others?

ANALYSIS

There is no easy answer to this question or questions. Studies are underway by BLM to determine if sites are more likely to be damaged by rehabilitation efforts or by the natural erosional processes or vandalism on sites that ensues where re-seeding is not conducted aggressively. The answers may vary by site type and by soil type, slope, and other factors.

Determinations on how to treat an archaeological or historic site are made by the agency in consultation with SHPO in most circumstances, and in consultation with the President's Advisory Council on Historic Preservation, where appropriate. Interested parties, Indian tribes, and others may participate in this consultation process, but the consultation does not begin until a project or class of projects has been identified.

All options should be considered, once an appropriate level of defensible data has been acquired.

SUBGROUP RECOMMENDATIONS

Studies should continue that will determine if sites are more likely to be damaged by rehabilitation procedures or by the natural erosional process and vandalism on sites where re-seeding is not aggressively conducted. These studies should take into account soil type, slope, and other factors.

Determinations on how to treat an archaeological or historical site should be made by BLM in consultation with SHPO, the President's Advisory Council, interested parties and Indian tribes.

State Director's Response

Fire Rehab Email lmacдона@ut.blm.gov

Introduction / Fire Rehab Primer / Photo Story / Myths vs Facts / RAC Recommendations
Subgroup Report / State Director's Policy / News Releases / Fire Rehab Handbook
< Home | News | Info | What We Do | BLM Facts | Directory >

Bureau of Land Management

Utah State Office

PO Box 45155

Salt Lake City, Utah 84145-0155

Phone: (801) 539-4001

Fax: (801) 539-4013

Created by Utah Bureau of Land Management

Last Updated: August 06, 1999

Send E-mail inquiries to Martha Harrison

2.) <http://www.cr.nps.gov/seac/protecting/html/3a-nickens.htm>

CHAPTER 3

ARCHAEOLOGICAL SITE DESTRUCTION

It takes only a period of about a dozen years to implant a basic culture in the mind of man--the period between the age of two and the age of fourteen. In a psycho-biological sense, history, tradition, and custom are only about 12 years old (Beardsley Rumi, World Trade and Peace Address, 1945).

THE DESTRUCTION OF ARCHAEOLOGICAL SITES AND DATA

Paul R. Nickens

Introduction

Archaeological sites are widely recognized as being limited in number and nonrenewable, much like several other natural resources. What distinguishes archaeological sites from many of the other resource concerns is their fragility, informational context, and necessary role in the theoretical, methodological and technical approaches for archaeological investigations of the past. Archaeologists and the interested public are acutely aware of the intrinsic nature of this resource base and of the need to protect it, both for wise use for research and preservation of significant resource elements for future generations.

Unfortunately, the characteristics of the archaeological record that make it so valuable also render it highly vulnerable to destructive forces generated from both natural and human origins. Cultural materials that make up the archaeological context range from being highly perishable, capable of being preserved only under the most unusual conditions, to nearly indestructible items such as stone and ceramic artifacts. However, for the archaeologist the spatial and temporal relationships are as important to reconstruction and interpretation of the past as the cultural debris itself.

This article provides a brief overview of the destructive processes which lead to alteration or loss of archaeological sites and data. We need to understand the stresses in today's environment, and we need to be able to predict the severity and rate of loss associated with the various threats. This forum only allows for a superficial examination of the overall situation, but the discussion will provide a background for other articles in this volume which outline various approaches for protecting archaeological sites.

Archaeological Sites as Resources

Before the various forces contributing to loss of archaeological sites and data are examined, a brief review of why archaeological sites deserve protection is beneficial. Historically, archaeological sites have been of great interest and value to the professionals and concerned avocational archaeologists who study the remains and lifeways of past human communities. Many of the larger important sites have also generated interest among the public in their appreciation for things of the past. Over the past few decades our society has come to realize that archaeological sites are finite in number and there has been an awareness that vestiges of our cultural heritage are being methodically destroyed, often at an alarming rate. The increasing demands upon our natural resources and the ever growing use of land surface throughout the country have prompted increased concern for the archaeological sites that remain in place.

While the archaeological site is often the center of the concern, we should remember that our concerns are better targeted at a larger picture, which may be designated as the cultural resource base. Lipe (1984) has defined the cultural resource base as "the material things produced by past human activity--the artifacts, manufacturing debris, middens, structures,

monuments, and the like, that have survived from some time in the past into the present." Lipe also notes that the landscapes of past cultures may also qualify as cultural resources.

Professional interest in the preservation of such resources lies in the fact that archaeological remains are a limited, fragile, nonrenewable part of the environment, and any disturbance creates irreversible and cumulative impacts. The following quote from an article by Scovill, Gordon, and Anderson (1977:44) succinctly expresses the important characteristics of archaeological resources for the professional community:

The investigation of the archaeological record of the American continent is the serious and scientific study of humankind over a span of time numbered in the tens of thousands of years. The study seeks knowledge-knowledge to describe, to explain, and to understand the behavior of past peoples and their interactions as integral parts of changing cultural and natural systems. Cultural history, cultural physiography, cultural ecology, and cultural processes are the current emphasis in the anthropological study of the past through the archaeological record.

Archaeological resources predominantly consist of the physical evidences, or cultural debris, left on the landscape by past societies.... Of high significance to the investigation, analysis, and interpretation of the cultural debris are the local and regional geomorphological sequences, soil composition, and modern biological and botanical baseline indicators. Critically essential to the methodologies, techniques, and processes of studying archaeological resources is the preservation of the undisturbed stratigraphic context of the cultural debris. Directly stated, the cultural debris of this nation's archaeological resources have no value for studying the past once they have been rearranged on the landscape by a bulldozer or a dragline.

These two paragraphs by Scovill and his co-authors clearly convey the feeling of the professionals regarding archaeological sites as significant resources and point to the reasons why protection of these resources is important for those charged with management of the nation's public lands. In addition to protection and wise use of the resource base today, we also need to be concerned with proper stewardship and preservation of resource elements for the future. As noted some years ago in an article by William Lipe (1974), it is highly desirable to save archaeological sites in place whenever possible as opposed to excavating them without consideration of preservation and thereby promoting removal of yet another piece of the rapidly disappearing resource. Lipe's arguments for a conservation ethic within the profession still have considerable relevance today.

An Overview of Archaeological Site Destruction

A number of agents can be identified which, in most cases, result in either damage, alteration, or complete loss of archaeological sites and data when the agent and the resource come into conflict. An outline of these destructive agents is shown in Figure 1. To be sure,

additional sources of disturbance could readily be identified and added to the list; however, those categories indicated cover the major threats to the resource base.

Before these categories are examined, some general comments can be offered concerning the various agents of destruction as they relate to site and data loss. The first, and perhaps most obvious, fact is that a large degree of interrelationship exists between the agents and modes of resource destruction noted in Figure 1 in that much association with respect to cause and effect circumstances is clearly evident among the various categories. For example, in some cases recreation on public lands and hobby collecting (or even malicious vandalism) may be considered interrelated activities. In other instances, the two may be quite differentiated. Likewise, a combination of erosion impacts and land reclamation undertakings may create an environmental battlefield with archaeological sites being among those resources caught in the middle.

The agents of destruction under discussion are not in every case completely harmful to archaeological sites and data. For example, many important archaeological sites would go unrecognized if not for natural erosion or human-caused land alteration, or even as a result of the efforts of interested hobbyists. Some of these agents, particularly the human incidental categories, lead to critical funding for data recovery programs when such activities take place on federal or state lands. However, far more archaeological sites are lost to these agents than are preserved, on public and private lands alike. It is well recognized that with the present legal, funding, and management situations, every worthy site cannot be investigated or even saved. On the positive side, though, the impacts generated by certain forms of destructive activities can be mitigated through increased effectiveness of educational and protective programs. Moreover, interest in reducing the effects of vandalism and finding ways to physically protect endangered resources is on the increase and meaningful results should be evident in the near future.

We also need to keep in mind that the archaeological record, by its very definition, is one that has lost important elements of critical information due to various destructive processes. As Michael Schiffer has noted in his various writings (e.g., 1976, 1983, 1987) on the formation processes affecting the archaeological record, cultural materials suffer varying degrees of informational loss as they are transformed from a systemic or ongoing behavioral system to the archaeological context. The rate of loss is especially calamitous for perishable items. Schiffer goes on to point out that the archaeological record may undergo changes which transform cultural materials from one state to another within the archaeological context (e.g., natural erosion or human intervention such as plowing or land leveling), and that the archaeological context may even return to a systemic one when the archaeologist (or vandal) retrieves the cultural materials. Our concern in this discussion is limited to the destructive processes which take place within the archaeological context and, more importantly, the conflicts which arise as the materials come face to face with the systemic contexts of today.

Agents of Destruction

Sources of potential destructive forces for archaeological sites and data come from almost every conceivable source in the environmental setting. The two major categories include those of

a natural origin and those associated with human activities on the landscape. The human agents can be further subdivided into incidental and intentional actions.

Natural Agents

Natural processes and events which affect archaeological sites are legion, ranging from the effects of earthworm and crayfish soil mixing to the devastating consequences of volcanic and earthquake events. In between these extremes we find that the activities of various plants and animals and erosive actions of wind, water, and temperature take a great toll on cultural materials in the archaeological context, leading to loss of items and abundant variation in the record. For the interested, excellent descriptions and discussions of these processes as they relate to archaeological sites can be found in Mathewson (1989), Schiffer (1987), Wildesen (1982), and Wood and Johnson (1978).

Human Agents

Human-caused actions which have harmful effects on archaeological sites and data are also multitudinous and continue to increase in number and magnitude as lands are developed and exploited and the pressures of population expansion increase. By and large, legislative actions at both the federal (see McManamon this volume) and state levels have been enacted to lessen or mitigate the effects of associated impacts to archaeological sites on public lands; however, the problems associated with many types of activities have in no way been totally eliminated. As they pertain to archaeological sites, destructive actions can be divided into two subcategories: incidental and intentional. As noted previously, the various actions which may be listed under either one of these headings are not totally independent of each other. The advent or growth of a land development activity, for example, will surely create a host of interrelated potential impacts, both in the short-and long-term, including, in all probability, a rise in the incidence of vandalism or depreciative behavior.

Incidental Actions

These activities may be defined as those destructive actions associated with the many forms of land development and resource exploitation that take place on the landscape. In other words, the destruction of archaeological sites and data is not the primary motive behind such actions, but the end result is that another part of the archaeological record disappears from the landscape. These activities may be generally categorized as (1) land development; (2) agriculture and land clearing; (3) grazing; (4) land reclamation and flood control; (5) water development projects; (6) recreational pursuits; (7) construction of roads, public utility features and pipelines; (8) mining and quarrying; and (9) industry.

In many cases, the precise effects of these types of land alteration activities have not been quantified; however, it is not difficult to imagine that each undertaking creates special and ultimately harmful results for the archaeological record if allowed to continue unchecked. These impacts lead to either partial or total destruction, or, at best, mixing and displacement of the resources.

Fortunately, the recent emphasis on proper resource management on public lands has brought about a better understanding of the range and seriousness of impacts resulting from such activities. This emphasis has also led to regulated identification and evaluation of archaeological resources in the impact zones and, when needed, effective mitigation of the adverse effects resulting from those impacts.

The body of literature examining the interplay between human occupation and use of the landscape and protection and preservation of archaeological sites and data has grown over the past twenty years as archaeologists have become more aware of the need to better understand the overall effects of such undertakings. Thus we can find references providing data on such potentially destructive and diverse activities as military training (Carlson and Briuer 1986), livestock grazing (Osborn et al. 1987), forest chaining (DeBloois et al. 1975, Haase 1983), river navigation (Gramann 1981), agricultural practices (Ford and Rollingson 1972, Medford 1972, Roper 1976, and Knoerl and Versaggi 1984), reservoir inundation (Lenihan et al. 1981), stream channelization (Schiffer and House 1977), traffic vibrations on prehistoric structures (King and Algermissen 1985), fire (Kelly and Mayberry 1980, Noxon and Marcus 1983, and Switzer 1974), and tourism (Gale and Jacobs 1987). In spite of these and other studies, many gaps still exist in our knowledge pertaining to the nature of specific impacts on archaeological resources from the various land disturbing activities listed above.

Intentional Actions

Intentional actions which lead to loss of archaeological sites and data are critical in that they are inherently harmful to the resource base, but, in most cases, are guided by motives that are difficult to prevent or control. The worst of these actions, those related to vandalism, are particularly damaging since they lead to destruction without any return of scientific information. Intentional actions causing resource destruction can be subdivided into three categories: institutionalized destruction, predatory vandalism, and malicious vandalism.

Institutionalized Destruction: Some forms of archaeological site and data destruction have been either tolerated or accepted over the years. In this category, we refer to the loss of cultural materials and information that occurs during professional investigation or associated with the management of archaeological resources.

At first, it may appear that to designate the activities of the archaeologist, whose goal it is to retrieve data from the archaeological context and make sense of it, as being destructive is somewhat contradictory. Realistically, however, it must be said that each and every archaeological endeavor leads to the loss of varying amounts of information. This situation will never be completely alleviated since far too many factors are involved (e.g., professional competence, data recovery techniques, and time and funding constraints). Further, we must recognize that a tremendous amount of archaeological data was lost during the early phases of discovery and investigation in this country when zeal often took predominance over scientific discretion. It is, however, difficult to excessively castigate many of those early efforts from our present-day vantage point. Undoubtedly, our successors will at some point in the future decry the "primitive" data recovery and analytical techniques used by archaeologists in the 1980's and 1990's and complain of the data loss which took place.

More to the point at hand, certain archaeological practices, which unfortunately continue to exist, do result in intentional and harmful effects to the resource base. These actions range from survey techniques in which, for example, artifacts are collected without corresponding mapping of artifact loci, to much more serious problems involving the use of limited research designs to guide excavation of archaeological sites. Even more damaging is the act of conducting investigative work and not pursuing the necessary analysis and reporting of the results. It is probably fair to state that in the past and even today some archaeological fieldwork was/is undertaken without any intention on the part of the investigator to adequately analyze the resultant data and make them available. Hopefully, the time is near when well-meaning but overworked investigators are no longer allowed to conduct field work beyond their capacity, professional or financial, to effectively complete the research process. As has been noted by others, this practice is little more than a form of archaeological vandalism.

Similar losses of archaeological sites and data can result from management practices on the part of agencies charged with this responsibility (see Spoerl 1988). Actions leading to resource destruction can include ineffective management orientations, a lack of rigorous evaluation methodologies for evaluating significance of sites, or failure to fully realize the impacts that an agency's activities or operations may have on archaeological resources. Examples of the latter activities might include the side effects from timbering actions or shoreline and downstream impacts to archaeological sites from operation of a reservoir.

Predatory Vandalism: This form of intentional activity is the most widespread and leads to the most serious consequences for archaeological resources (Nickens et al. 1981, U.S. General Accounting Office 1987). It is characterized by a motive dictated by personal gain, either of a noncommercial or commercial nature. In the first case, the effort may involve actions such as adding items to one's collection of relics, satisfying a curiosity about antiquities, or perhaps egocentric autographing of resource sites. Commercial ventures are guided by a motive of retrieving artifacts for sale and profit. In either case, the impact to archaeological resources is much the same, loss of cultural elements and contextual information.

To understand the problem it will be useful to examine its extent as indicated by one study completed a few years ago. In that investigation, Williams (1978) surveyed the management problem of cultural resource vandalism in federal and state agency recreation areas throughout the Rocky Mountain West. In compiling the results provided by resource managers throughout several states, Williams listed the following vandalism practices which impact cultural resource sites (arranged in decreasing order by reported absolute frequency):

- Excavation (digging, pothunting, use of heavy machinery)
- Carving, scratching, chipping, general defacement
- Surface collection of artifacts (especially lithic artifacts)
- Removing, shooting at, painting, chalking, making casts and tracings of rock art
- Theft of artifacts from structures
- Stripping weathered boards or other timbers
- Removing part or all of a structure or causing structural damage
- Dismantling, general destruction of structure (but apparently no removal)

recreational Arson
 Climbing or walking on resources
 Building new roads over, using modern vehicles on historic roads, offroad
 vehicle use
 Rearrangement of or relocating of resources
 Breaking artifacts, objects, windows
 Breaking and entering
 Knocking structures over
 Use as firewood
 Throwing rocks into excavated ruin
 Handling, touching

Malicious Vandalism: The final category of intentional vandalism includes acts which may be classified as those brought about by revenge or frustration with government policies, or those which result from no discernible motive at all (Chokhani 1979:10). Basically, this category of vandalism includes those inexplicable, unprovoked actions for which there are no avowed motives. Such behavior can be the result of wanton activities, or even the end product of psychotic or inebriate conduct. Fortunately, this type of aggressive vandalism, quite often highly destructive in nature, occurs less frequently in comparison to other forms of vandalistic behavior. An example of such senseless vandalism occurred in 1979 at Arches National Park near Moab, Utah, where a highly significant rock art panel was obliterated by brushing a chemical solvent across the panel face (Noxon and Marcus 1980).

Conclusion

The aim of the foregoing discussion has been to review the various agents which interact to extirpate elements of our nation's archaeological heritage. The importance of maintaining archaeological sites in pristine conditions cannot be understated, nor can the need to provide protection and preservation for the vestiges of this resource. The actions of natural processes upon archaeological sites and the ever-expanding demands by our population on the landscape are agents of destruction that will continue to adversely affect archaeological resources. It is simply not possible to completely halt all the detrimental stresses resulting from environmental processes. The effects of such impacts can, in many cases, be mitigated by using physical protection technologies, given appropriate need and funding. It should be noted that the natural agents of destruction tend to occur more slowly than human-caused actions and therefore may be considered to have a lower overall priority in cultural resource management than those detrimental effects tied to human activities. However, given the amount of past destruction of archaeological sites and data and that continuing today, we cannot afford hesitation on any front of the conservation battle.

While some problems still exist, incidental impacts to archaeological resources as by-products of land alteration and resource exploitation are by and large mitigated by legislative enactments, at least on federal and state lands. Control of vandalism, however, continues to be a

formidable challenge. Severe problems continue to be associated with destructive actions on private lands, with the result being that valuable archaeological remains are disappearing at an alarming rate. This fact makes it even more important that such resources on public lands be adequately protected.

References Cited

Carlson, D. L. and Briuer, F. L. (1986) Analysis of Military Training Impacts on Protected Archaeological Sites at West Fort Hood, Texas. U.S. Army Fort Hood, Archaeological Resource Management Series, Research Report No. 9, Fort Hood.

Chokhani, P. (1979) Destruction on the Public Lands: A Closer Look at Vandalism. *Our Public Lands* 29:9-11.

DeBloois, E., Green, D., and Wylie, H. (1974) A Test of the Impact of PinyonJuniper Chaining on Archaeological Sites. U.S.D.A. Forest Service, Intermountain Region, Ogden.

Ford, J. L. and Rolingson, M. (1972) Site Destruction Due to Agricultural Practices in Southeast Arkansas. Arkansas Archeological Survey, Research Series 3:1-40.

Gale, F. and Jacobs, J. M. (1987) Tourists and the National Estate: Procedures to Protect Australia's Heritage. Australian Heritage Commission, Publication Series No. 6, Canberra.

Gramann, J. H. (1981) Navigation-Related Impacts on Cultural Resources of the Upper Mississippi River System. *Contract Abstracts and CRM Archeology* 2(3):11-16.

Haase, W. R. (1983) Mitigation of Chaining Impacts to Archaeological Sites. *Journal of Range Management* 36:158-160.

Kelly, R. E. and Mayberry, J. (1980) Trial by Fire: Effects of NPS Burn Programs upon Archaeological Resources. In *Proceedings of the Second Conference on Scientific Research in the National Parks*, Vol. 1, pp. 603-610, U.S. Government Printing Office, Washington.

King, K. W. and Algermissen, S. T. (1985) Seismic and Vibration Hazard Investigation of Chaco Canyon National Park. U.S. Geological Survey Open File Report 85-529, Denver.

Knoerl, J. J. and Versaggi, N. (1984) Plow Zone Sites: Research Strategies and Management Policy. *American Archaeology* 4:76-80.

Lenihan, D. J., Carrell, T. L., Fosberg, S., Murphy, L., Rayl, S. L., and Ware, J. A. (1981) The Final Report of the National Reservoir Inundation Study, 2 Vols. National Park Service, Southwest Cultural Resources Center, Santa Fe.

Lipe, W. D. (1974) A Conservation Model for American Archaeology. *The Kiva* 39:213-243.

Lipe, W. D. (1984) Value and Meaning in Cultural Resources. In *Approaches to the Archaeological Heritage*, pp.1-11. Ed. H. Cleere, Cambridge University Press, Cambridge.

Mathewson, C. C., Ed. (1989) Interdisciplinary Workshop on the PhysicalChemical-Biological Processes Affecting Archeological Sites. U.S. Army Engineer Waterways Experiment Station, Contract Report EL-89-1, Vicksburg.

Medford, L. D. (1972) Agricultural Destruction of Archeological Sites in Northeast Arkansas. *Arkansas Archeological Survey, Research Series*, 3:41-82.

Nickens, P. R., Larralde, S. L. and Tucker, G. C. (1981) A Survey of Vandalism to Archaeological Resources in Southwestern Colorado. Bureau of Land Management - Colorado, Cultural Resources Series, No. 11, Denver.

Noxon, J. S. and Marcus, D. A. (1980) The Moab Panel Site of Southeastern Utah: Its Defacement and Significance in Southwestern Prehistory. *American Rock Writing Research Newsletter* 1(5-80):1-3.

Noxon, J. S. and Marcus, D. A. (1983) Wildfire-Induced Cliff Face Exfoliation and Potential Effects on Cultural Resources in the Needles District of Canyonlands National Park, Utah. *Southwestern Lore* 49(2):1-8.

Osborn, A., Vetter, S., Hartley, R., Walsh, L., and Brown, J. (1987) Impacts on Domestic Livestock Grazing on the Archaeological Resources of Capitol Reef National Park, Utah. National Park Service, Midwest Archeological Center, Occasional Studies in Anthropology, No. 20, Lincoln.

Roper, D. C. (1976) Lateral Displacement of Artifacts Due to Plowing. *American Antiquity* 41:372-375.

Schiffer, M. B. (1976) *Behavioral Archeology*. Academic Press, New York.

Schiffer, M. B. (1983) Toward the Identification of Formation Processes, *American Antiquity* 48:675-706.

Schiffer, M. B. (1987) *Formation Processes of the Archaeological Record*. University of New Mexico Press, Albuquerque.

Schiffer, M. B. and House, J. H. (1977) Assessing Impacts: Examples from the Cache Project. In *Conservation Archaeology: A Guide for Cultural Resource Management Studies*, pp. 309-320. Eds. M. B. Schiffer and Gumerman, G. J., Academic Press, New York.

Scovill, D. H., Gordon, G. J., and Anderson, K. M. (1977) Guidelines for the Preparation of Statements of Environmental Impact on Archaeological Resources. In *Conservation Archaeology: A Guide for Cultural Resource Management Studies*, pp. 43-62. Eds. M. B. Schiffer and Gumerman, G. J., Academic Press, New York.

Spoerl, P. M. (1988) Management Impacts on Cultural Resources: an Assessment of Forest Service Research Needs. In *Tools to Manage the Past: Research Priorities for Cultural Resources Management in the Southwest*, pp. 17-25. Eds. J. A. Tainter and Hamre, R. H., U.S.D.A. Forest Service, Rocky Mountain Forest and Range Experiment Station, General Technical Report RM-164, Fort Collins.

Switzer, R. R. (1974) The Effects of Forest Fire on Archaeological Sites in Mesa Verde National Park, Colorado. *The Artifact* 12:1-8.

U.S. General Accounting Office (1987) Cultural Resources: Problems Protecting and Preserving Federal Archeological Resources. GAO/RCED-88-3. U.S. Government Printing Office, Washington.

Wildesen, L. E. (1982) The Study of Impacts on Archaeological Sites. In *Advances in Archaeological Method and Theory*, Vol. 5, pp. 51-96. Ed. M. B. Schiffer, Academic Press, New York.

Williams, L. R. (1978) Vandalism to Cultural Resources of the Rocky Mountain West. U.S.D.A. Forest Service, Southwestern Region, Cultural Resources Report No. 21, Albuquerque.

Wood, W. R. and Johnson, D. L. (1978) A Survey of Disturbance Processes in Archaeological Site Formation. In *Advances in Archaeological Method and Theory*, Vol. 1, pp. 315-381. Ed. M. B. Schiffer, Academic Press, New York.

Society for California Archaeology
Fire Effects Symposium Abstracts 1999

Symposium on Fire Effects to Obsidian

Society for California Archaeology
33rd Annual Meeting, Sacramento, California, 1999

Tom Origer and Dave Fredrickson, Organizers and Chairs.

The Effects of Fire/Heat on Obsidian.

For several decades, a number of researchers have examined the effects that fire/heat has on obsidian specimens. Some studies were focused on the after-effects of wildfires, some on controlled burns, and still others on conditions created under laboratory conditions. An understanding of the effects of fire/heat on obsidian specimens continues to gain in importance as land managers increasingly use fire to control fuel buildup in woodlands and forests and alter vegetation patterns (i.e., improve pastureland). This session brings together researchers to describe their work and findings in a setting conducive to discussion, debate, and sharing of information.

Benson, Arlene Humboldt-Toiyabe National Forest

Effects of Fire on Obsidian Hydration Rind Thickness

In September 1996, ninety obsidian samples were treated to low, moderate, and high intensity fire during a prescribed fire in a high mountain sagebrush environment. Thermocouples were used to record maximum temperatures reached at each sample during the burn. Then control samples were not treated to fire. The obsidian hydration rinds of all 100 samples included in the study were measured before and after the study. Changes in hydration rind thickness of both treated and untreated obsidian samples will be described and implications discussed.

Deal, Krista Eldorado National Forest

and Denise McLemore

Effects of Prescribed Burning on Obsidian and Implications for Reconstructing Past Landscape Conditions

Hydration bands on surface and near-surface obsidian often become diffused and unreadable following wildfires. The assumption has been that less intense fires, like those prescribed for management purposes, do not reach temperatures that would effect hydration bands, although there has been little data to support this assumption. The current study measured the effects to archaeological obsidian of both temperature and duration of heat in two prescribed burns with differing fuel loads. Preliminary results indicated that duration of exposure to heat, even at low temperature creates effects on hydration bands similar to those of elevated temperatures. These results have potential implications for expanding fire histories beyond the 400-year limit of tree-coring, for reconstructing prior landscape conditions and Indian burning practices, for archaeological interpretations, and for cultural resource and ecosystem management.

Fredrickson, David A. Sonoma State University

No abstract.

Green, Dee Warner Mountain Ranger District, USDA Forest Service

Re-Hydrated Obsidian Projectile Points on the Warner Mountains, California

Fire is the only known method, in the natural environment, which can remove hydration rinds from obsidian. In cases where early archaic projectile points show hydration rinds which reflect what is thought to be a much later time period, there is a probability that such points have been subjected to fire and then re-hydrated. This paper examines a collection of such points from the Warner Mountains of northeastern California. Distributions of all hydrated points, by watershed, are examined and plotted. The utility of re-hydrated points in studies of fire history is examined.

Halford, F. Kirk (with contributions from Anne S. Halford) Bureau of Land Management
The Trench Canyon Prescribed Burn: An Analysis of Fire Effects on Archaeological Resources Within the Sagebrush Steppe Community

Prescribed fire is becoming a common tool on Public Lands to manage fire behavior, fuel loading, and vegetation community associations. The effects of this management practice on archaeological resources is of concern. This paper will focus on the effects of a prescribed burn on the hydration birefringent rim of obsidian artifacts. In particular, this analysis addresses the differential effects of fire within three quantified fuel zones within late seral Great Basin sage (*artemisia tridentata* spp. *tridentata*) and upland sagebrush steppe community types.

Kelly, Roger National Park Service

An Overview of Obsidian Studies Within NPS Park Projects

From clumsy field experiments to higher-tech laboratory efforts, National Park Service archeological staff have explored heat effects upon obsidian for nearly two decades. Early assumptions and guesses have lead to systematic and organized data collecting, but mostly post-prescription burns or post-wildlife campaigns. What have we – as one agency – learned about changes or lack of change in obsidian materials as found within several California NPS park units? And also, what about the neighboring NPS park units elsewhere in the West where comparative data exist? Are we working better with our fire program colleagues as a result of greater understanding about obsidian and fire?

Loyd, Janine Sonoma State University Obsidian Laboratory

Rehydration of Burned Obsidian

Obsidian specimens have, no doubt, been exposed to fire during prehistoric and historic times, sometimes deliberately, but most often unintentionally as in the case of wildfires. Three basic questions present themselves when looking at the effects of obsidian having been exposed to fire. Does obsidian lose hydration when it is burned? Does obsidian have the ability to rehydrate after it has been exposed to fire? Does the temperature at which the obsidian was burned effect obsidian rehydration? This paper presents the results of experiments designed to address these questions.

Origer, Tom Sonoma State University.

No abstract.

Schroder, Sue Ann Sonoma State University Obsidian Laboratory

A synthesis of Previous Studies that Explored the Effects of Fire on Obsidian: Where we've Been and Where We're Going

Some 15 unpublished and published documents related to fire/heat effects on obsidian were reviewed. Virtually each document described a different set of procedures that were used to

determine whether fire/heat had affected hydration bands. The broad range of study procedures resulted in a shared conclusion – hydration bands were affected by fire/heat in some way. This paper will synthesize and describe analytical techniques and results of prior studies, with the intent of creating a solid foundation upon which future studies can be designed.

Shackley, M. Steven Archaeological XRF Laboratory, Phoebe Hearst Museum of Anthropology, University of California, Berkeley

and Carolyn Dillian

Thermal and Environmental Effects on Obsidian Geochemistry: Experimental and Archaeological Evidence

Recent EDXRF compositional studies of thermally altered archaeological obsidian from a number of late period sites in New Mexico and Arizona suggested that extreme thermal alteration may have been responsible for the depletion of elemental concentrations in the mid-Z x-ray region; a region where the most sensitive incompatible elements for the discrimination of archaeological obsidians reside. A stepped heating experiment subjecting samples of peraluminous to peralkaline artifact-quality obsidian to temperatures between 500EC and 1080EC indicated that at temperatures over 1000EC extreme mechanical changes occur, but the elemental composition in the mid-Z region does not vary beyond that expected in typical instrumental error. It appears that the apparent depletion of elemental concentrations in the archaeological specimens is due to EDXRF analysis of surface regions where melted sands bonded to the surface glass are incorporated into the results. If accurate analyses of burned obsidian artifacts are desired, the layer of melted sand from the depositional contexts must be removed before analysis.

Siefkin, Nelson National Park Service, Redwood National and State Parks

Manual Fuel Load Reduction as a Means of reducing the Effects of Fire on Obsidian Hydration: An Example from Lassen Volcanic National Park

Each of the four National Park Service Units of northern California – Lassen Volcanic National Park, Lava Beds National Monument, Redwood National Park and the Whiskeytown National Recreation Area – have prescribed fire programs which are conducted in areas with radically different vegetation types. As a result, the archeological survey strategy and the assumptions about the effects of fire on obsidian (and other cultural resources), in each unit, differ, as do the protective measures for these resources. In 1998, National Park Service and California Department of Forestry personnel removed a substantial amount of dead and down woody fuel from the surface of a large lithic scatter in Lassen Volcanic. In the absence of funds for obsidian hydration, subsurface testing, and other studies, manual fuel load reduction may be a viable means of protecting obsidian from the effects of high temperature controlled burns and wildfires.

Skinner, Carl N. USFS, Pacific Southwest Research Station
and C. Phillip Weatherspoon

Fire Regimes and Fire History: Implications for Obsidian Hydration Dating

That fire can alter the hydration bands of obsidian specimens and thus affect the accuracy of dating is well known. It is also well known that before the 20th Century, fires were generally

frequent (intervals of 5-20 years were common) in most forest, woodland, grassland, and shrub ecosystems of the western U.S. and especially California. Thus, it is likely that obsidian material that has been unprotected for more than a few decades on or near the soil surface has been exposed to fire. Only material that was buried and remained so after it was no longer used is likely to have escaped being influenced by fire. Fire intensity and duration of burning are highly variable and dependent upon the nature of the available fuels and weather conditions. Thus, high variability in dates inferred from hydration rinds should be expected from artifacts that have been exposed to the effects of past fires.

Smith, Jim California Department of Forestry and Fire Protection

Protecting Archeological Sites with Prescribed Fire

Past fire studies have shown that fire has a measurable effect on the hydration rind that forms on obsidian artifacts. Ecosystem management requires the reintroduction of fire through either prescribed fires or to allow wildfires to burn unabated. Wildfires are happenstance, and when occurring in areas where significant archeological resources are located, damage to sites can occur not only through suppression actions but from the unnatural fire intensities generated from accumulated fuel loading attributed to successful fire management practices. Wildfires therefore, do not afford the opportunity for archeologist to successfully protect known and newly discovered sites. Prescribed fire, through proper planning and site surveys, can protect archeological resources and allow the reintroduction of fires as a natural process in fire dependent ecosystems.

Soloman, Madeline Sonoma State University and California Department of Forestry and Fire Protection

Fire and Glass: Experimental Approaches to Understanding the Effects of Prescribed Burning on Obsidian Hydration Bands

During field experiments conducted in spring 1998 at Boggs Mountain Demonstration State Forests in Lake county, California, the hydration bands on obsidian artifacts placed in ground surface and subsurface contexts were not affected by exposure to prescribed burn conditions. Subsequent laboratory experiments at Sonoma State university suggested that hydration bands may not be affected by prolonged exposure (24 hours) to temperatures of 100°C or below. These findings are considered in light of previous research on the effects of prescribed fire on obsidian hydration bands, and it is suggested that an examination of the specific prescription involved in a proposed burn is an essential factor in determining the likelihood that hydration bands may become damaged during prescribed burning. As additional studies are needed to expand and refine our understanding of the effects of fire on hydration bands, several experimental approaches are proposed and discussed.

Steffen, Anastasia University of New Mexico

The Dome Fire Study: Extreme Forest Fire Effects on Jemez Obsidian

The 1996 Dome Fire burned over several obsidian source locations in Jemez Mountains of northern New Mexico. At one site, Capulin Quarry, the effects of the wildfire on obsidian were remarkably severe – including artifact bubbling, bloating, and complete destruction through vesiculation. This paper presents these effects along with an exploration of why obsidian at this source (Rabbit Mountain / Cerro Toledo rhyolite) had such a volatile response during this forest fire.

Field Office Fire Effects Bibliographies

Field Office Bibliographies

Fire Effects Bibliography, Kingman Field Office

Allen, Craig D, editor

1996 *Fire Effects in Southwestern Forests: Proceedings of the Second La Mesa Fire Symposium, Los Alamos, New Mexico, March 29-31, 1994*. USDA Forest Service, General Technical Report RM-GTR-286.

COMMENT: Kingman FO has title page but not the report.

Benson, Arlene

? *Meadow Canyon Prescribed Burn: The Effects of Fire on Obsidian Hydration Rinds*.

COMMENT: Author is District Archaeologist, Tonopah Ranger District (USFS)

Berger, Mary, & Don Simonis.

? *Archaeological Evaluation of Hibernia Burn Phase I*.

COMMENT: This is a report written for the Kingman FO.

Brown, Gregory B, & Lisa Folb

1996 *West Mesa and Walnut Canyon Burn: Archaeological Survey Report*. Northern Arizona University, Anthropology Laboratories Report #1169. Submitted to USDI NPS 2717 N. Steves Blvd. Suite 3. Flagstaff, AZ 86004.

Cartledge, Thomas R.

? Heritage resources and fire management: A resource management crossroads. In ? pp. 206-214.

Cole, Sally J.

1997 *Documentation of Battleship Rock Petroglyph Site, MV2469, After the 1996 Soda Canyon Wild Fire*. Report prepared for Mesa Verde NP, Colorado.

COMMENT: Includes photographic documentation of site by Laurel J Casjens

Deal, Krista.

1999 *Effects of Prescribed Fire on Obsidian & Implications for Reconstructing Past Landscape Conditions*. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. April 1999.

Green, Dee, and Kirsten Bordwell, Randall Hall, and Andrew Goheen

1997 *Effects of Prescribed Fire on Obsidian Hydration Rates*. USDA Forest Service, Warner Mountain Ranger District, Modoc National Forest.

Jackson, Robert J.

1997 *Prescribed Fire and Protection of Heritage Resources: A Heritage Resources Management Module Prepared for the USDA Forest Service, Pacific*

Southwest Region, National Forests of the Sierra Nevada.

Kelly, Rose E.

- 1999 *An Overview of Obsidian Studies Within Western US Parks*. Paper presented at the Annual Meeting of the Society for California Archaeology, San Francisco. April 1999.

Kight, Bill.

- 1994 *The Effects of Fire on Cultural Resources: A Survey of Literature Pertaining to Fire Control & Management*. Edited by Frederic J Athern & Henry S Keesling. Colorado State Office, BLM. Denver, Colorado.

Lentz, Stephen C., Joan K Gaunt, Adisa J. Willmer, & others.

- 1996 *Fire Effects on Archaeological Resources Phase 1: The Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico*. General Technical Report RM-GTR-273. USDA Forest Service. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Pilles, Peter, jr.

- 1984 *The Effect of Forest Fires on Archaeological Sites*. Paper presented at the 49th Annual Meeting for the Society for American Archaeology, Portland. April 1984.

Schroder, Sue-Ann.

- 1999 *A Synthesis of Previous Studies that Explored the Effects of Fire on Obsidian: Where We've Been & Where We're Going*. Paper presented at the symposium: The Effects of Fire/Heat on Obsidian. 33rd Meeting of the Society for California Archaeology. April 1999.

Bishop Field Office: Trench Canyon Prescribed Fire Study Bibliography.

Anderson, Hal E.

- 1982 *Aids to Determining Fuel Models for Estimating Fire Behavior*. *USDA Forest Service, General Technical Report* INT-122. Intermountain Forest and Range Experimental Station, Ogden Utah.

Anderson, Jessica and Thomas M. Origer

- 1997 *Adding A Little Fuels To The Fire: Some Thoughts On Fire And Obsidian Hydration*. *International Association for Obsidian Studies Bulletin* No. 19:17-20.

Canfield, R.H.

- 1941 Application of the line interception method in sampling range vegetation. *J. Forestry* 39:388-394.

Connor, Melissa A., Kenneth P. Cannon, and Denise C. Carlevato

1989 The Mountains Burnt: Forest Fires and Site Formation Processes. *North American Archeologist* 10(4):293-310.

Deal, Krista

1997 Fire Histories, Fuel Loads And Obsidian: Preliminary Results Of A Prescribed Burn Experiment On The Eldorado National Forest. Paper presented at the California Committee Meeting, October 1997, Placerville, California.

Deal, Krista and Denise McLemore

1997 Fire Obsidian and Ecosystems Management: Some Burning Issues. Manuscript on file at the Eldorado National Forest, Placerville, California.

Duncan, Faith L.

1990 Long Mesa Fire. Fire Effects and Cultural Resources: An Annotated Bibliography. Publication No. 2, *Division of Research and Cultural Resource Management*, Mesa Verde National Park.

Eininger, Susan F.

1990 Long Mesa Fire 1989, Archeological Survey and Post Fire Assessment. Manuscript on file at the Superintendent's Office, Mesa Verde National Park.

Everett, R. L., Ward K.

1984 Early plant succession on pinyon-juniper controlled burns. *Northwest Science* 58(1):57-68.

Grayson, Donald K.

1993 *The Desert's Past: A Natural Prehistory of the Great Basin*. Smithsonian Institution Press, Washington and London.

Green, Dee F., Kirsten Bordwell, Randall Hall, and Andrew Goheen

1997 Effects Of Prescribed Fire On Obsidian Hydration Rates. Manuscript on file at USDA Forest Service, Warner Mountain Ranger District, Modoc National Forest, Alturas, California.

Hull, Kathleen L.

1991 Archeological Survey and Post-Fire Surface Evaluation of the Foresta, Big Meadow, and McCauley Meadow Areas, Yosemite National Park, California. Research Center Publications in Anthropology, No. 11.

Jackson, Robert J.

1997 Prescribed Fire And The Protection Of Heritage Resources. A Heritage Resource Management Module prepared for the USDA, Forest Service, Pacific Southwest Region, National Forests of the Sierra Nevada. Manuscript on file at Sequoia National Forest, California and Pacific Legacy, Inc.

Lentz, Stephen C., Joan K. Gaunt, and Adisa J. Wilmer

1996 Fire Effects On Archaeological Resources, Phase 1: The Henry Fire, Holiday Mesa,

Jemez Mountains, New Mexico. *USDA, Forest Service, General Technical Report RM-GTR-273*. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Mason, R.B.

1981 Response of birds and rodents to controlled burning in pinyon-juniper woodlands. Unpublished Masters Thesis, University of Nevada, Reno, Nevada.

Origer, Tom

1996 Obsidian Hydration. In *Fire Effects On Archaeological Resources, Phase 1: The Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico*, Stephen C. Lentz et al., pp. 81-82. *USDA, Forest Service, General Technical Report RM-GTR-273*. Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Reynolds, Linda A.

1998 Heritage resources and Prescribed Fires, Inyo National Forest, California and Nevada. Forest Supplement to Prescribed Fire And The Protection Of Heritage Resources. A Heritage Resource Management Module prepared for the USDA, Forest Service, Pacific Southwest Region, National Forests of the Sierra Nevada. Manuscript on file at Inyo National Forest, Bishop, California.

Sheeter, G.R.

1968 Secondary succession and range improvements after wildfire in northeastern Nevada. Unpublished Masters Thesis, University of Nevada, Reno, Nevada.

Skinner, Craig E. and Jennifer J. Thatcher

1998 X-Ray Fluorescence Analysis and Obsidian Hydration Rim Measurement of Artifact Obsidian from the Trench Canyon Site (CA-017-97-29), Mono County, California. Northwest Research Obsidian Studies Laboratory Report 98-73.

Stine, S.

1990 Late Holocene Fluctuations of Mono Lake, eastern California. *Palaeogeography, Palaeoclimatology, Palaeoecology* 78:333-381.

Stubbendieck, J., Hatch, S.L., Hirsch, K.J.

1986 *North American range plants*. 3rd ed. Lincoln, NE: University of Nebraska Press.

Trembour, Fred N.

1979 A Hydration Study of Obsidian Artifacts, Burnt vs. Unburnt by the La Mesa Fire. In the *La Mesa Fire Study: Investigation of Fire and Fire Suppression on Cultural Resources in Bandolier National Monument*. Southwest Cultural Resources Center, Sante Fe, New Mexico.

Vallentine, J.F.

1961 Important Utah range grasses. *Extension Circular* 281, Utah State University, Logan, Utah.

Ward, K.V.

1977 Two-year vegetation response and successional trends for spring burns in the pinyon-juniper woodland. Unpublished Masters Thesis, University of Nevada, Reno, Nevada.

Wright, H.A., Bailey, A.W.

1982 *Fire Ecology: United States and southern Canada*. Jon Wiley and Sons, New York.

Wright, H.A., Lemmedson, J.O.

1965 Effect of fire on bunchgrasses of the sagebrush-grass region in southern Idaho. *Ecology* 46(5): 680-688.

Zshaechner, G.A.

1985 Studying rangeland fire effects: a case study in Nevada. In: Sanders, Ken; Durham, Jack, eds. *Rangeland fire effects: Proceeding of the symposium*; Boise ID. U.S. Department of the Interior, Bureau of Land Management, Idaho State Office: 66-84.

Bibliography of Fire Effects on Cultural Resources

**Compiled by
Trisha Rude and Anne Trinkle Jones**

**May 23, 2001
National Park Service
Western Archeological and Conservation Center
1415 N. Sixth Avenue
Tucson, AZ 85705**

Preface

This bibliography is a by-product of a joint effort between the National Park Service and the USFS Fire Sciences Lab to produce a review of knowledge on fire effects on cultural resources. The main product of the project will be a “Rainbow Series” volume on fire effects on cultural resources and archeology (Jones and Ryan, in preparation). The bibliography does include some references on the historical and traditional uses of fire and on the history of fire. However as an aid to authors of the Rainbow volume, its primary focus is on the direct and indirect effects of heating on various types of cultural resources. Kevin Ryan of the Fire Sciences Lab and Trinkle Jones of Western Archeological and Conservation Center (WACC) deserve credit for making this project possible. Both have been of immeasurable assistance to me throughout my work on this project.

Most literature concerning fire effects on cultural resources is unpublished “gray literature.” Many of the references cited in this bibliography are fairly obscure. Over the course of about 13 months, I was able to obtain a great deal of the literature cited here. This material is now on file at the Western Archeological and Conservation Center in Tucson. It will be made available by appointment. The process of collecting this material required the assistance of many people. I called numerous USFS ranger districts and BLM offices, e-mailed several authors and solicited the input of several “pyro-archeologists.” Numerous people responded to my e-mails and phone calls; several folks were willing to send me reports and manuscripts to put on file at WACC. Everybody who helped me in this effort deserves a lot of thanks.

Archeologist Trinkle Jones, librarian Johanna Alexander, and I began our searches for fire effects literature with Faith Duncan’s annotated bibliography (Duncan 1990). She created a comprehensive list of references on fire effects on cultural resources, which was a tremendous help to our project. Additional references were found by reviewing other bibliographies and reference lists or were submitted by people interested in the subject. Citations were checked for accuracy by obtaining hard copies in-house or at the library or by confirming that a reference was cited the same way by at least two authors. Some of Duncan’s references, especially letters, could not be relocated so are not included in this bibliography. To date, the bibliography is available in ProCite and MS-Word formats, and we plan to make it available on the Internet. I hope that this work will be helpful to all those people trying to bring together the worlds of fire, archeology and resource management.

Trisha Rude
Tucson, Arizona
24 April 2001

Bibliography of Fire Effects on Cultural Resources

Agee, J. K.

1993 *Fire Ecology of Pacific Northwest Forest*. Island Press, Washington, D.C.

Keywords: Burn management/Fire cycle/Vegetation/Fire, historical use of.

Ahler, S. A.

1983 Heat Treatment of Knife River Flint. *Lithic Technology* 12(1):1-8.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Ahler, S. A., P. R. Picha, R. D. Sayler, and R. W. Seabloom

1990 Effects of Prairie Fire on Selected Artifact Classes. Paper presented at the Annual Meeting of the Society for American Archaeology, Las Vegas.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Post-burn/Pre-burn/Vegetation/Stone, artifactual/Ceramic, prehistoric/Glass/Wood, artifactual/Charcoal/Shell.

Ahler, S. A., P. R. Picha, R. W. Seabloom, and R. D. Sayler

1989 Impacts of Prescribed Burning on Selected Cultural Resources. Paper presented at the 47th Plains Anthropological Conference, Sioux Falls, South Dakota. Draft on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Post-burn/Pre-burn/Vegetation/Stone, artifactual/Ceramic, prehistoric/Glass/Wood, artifactual/Charcoal/Shell.

Anderson, B. A

1985 Archaeological Considerations for Park and Wilderness Fire Management Planning. *Proceedings - Symposium and Workshop on Wilderness Fire*, pp. 145-147. General Technical Report No. INT-182. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Keywords: Archaeology/Archeology/Cultural resources/Burn management/Fire suppression, impact of.

Anderson, J., and T. M. Origer

1997 Adding a Little Fuel to the Fire: Some Thoughts on Fire and Obsidian Hydration. *IAOS Bulletin* 19:17-20. From a paper presented at the 31st Annual Meeting of the Society for California Archaeology, Rohnert Park, California. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Cultural resources/Archeology/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Anderson, K.

1992 From Burns to Baskets. *News from Native California* 6(2):6-7. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of/Cultural resources.

1993 *Indian Fire-Based Management in the Sequoia-Mixed Conifer Forests of the Central and Southern Sierra Nevada*. Submitted to Yosemite Research Center, Yosemite National Park, Cooperative Agreement Order Number 8027-2-002. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of/Burn management.

Anderson, M. K., and M. J. Moratto

1996 Native American Land-Use Practices and Ecological Impacts. In *Assessments and Scientific Basis for Management Options*. Status of the Sierra Nevada: Sierra Nevada Ecosystems Project Final Report to Congress, vol. II. University of California Centers for Water and Wildland Resources, Davis.

Keywords: Burn management/Fire, historical use of.

Archeological Site Hazardous Fuels Assessment Program (ASHFAP)

1998 *Guadalupe Mountains National Park Archeological Site Hazardous Fuel Assessment Report*. Guadalupe Mountains National Park, Salt Flat, Texas. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Preventative treatment/Fuel reduction.

Arno, S. F.

1976 *The Historical Role of Fire on the Bitterroot National Forest*. Research Paper No. INT-187. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Keywords: Fire cycle/Vegetation.

1983 Ecological Effects and Management Implications of Indian Fires. Paper presented at the Wilderness Fire Symposium, Missoula, Montana.

Keywords: Fire, historical use of/Burn management.

Arno, S. F., and K. M. Sneck

1977 *A Method for Determining Fire History in Coniferous Forests of the Mountain West*. General Technical Report No. INT-42. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Keywords: Fire cycle/Vegetation.

Ayers, J. A.

1989 *Post-Fire Assessment of Historic Sites, Yellowstone National Park, 1988*. National Park Service, Rocky Mountain Regional Office, Denver. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/Fire effects/Post-burn.

Barrett, S. W.

1981a Indian Fires in the Pre-Settlement Forests of Western Montana. In *Proceedings of the Fire History Workshop, October 20 - 24, 1980, Tucson, Arizona*, M. A. Stokes and J.

H. Dieterich, pp. 35-41. General Technical Report No. RM-81, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.
Keywords: Fire, historical use of/Fire cycle.

1981b *Relationship of Indian-Caused Fires to the Ecology of the Western Montana Forests*. Report No. 4. United States Department of Agriculture, Northern Region, Missoula, Montana.

Keywords: Cultural resources/Fire, historical use of/Burn management/Vegetation.

2000 Fire History Along the Ancient Lolo Trail. *Fire Management Today* 60(3):21-28. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of.

Barrett, S. W., and S. F. Arno

1982 Indian Fires as an Ecological Influence in the Northern Rockies. *Journal of Forestry* 80:647-651.

Keywords: Fire effects/Fire, historical use of.

Bayer, C.

1979 *The Chalone Creek/South Pinnacles Prescribed Burn, Initial Archaeological Investigations*. Bureau of Land Management, Folsom District. On file, Bureau of Land Management, Hollister Field Office, Hollister, California, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Fire effects/Pre-burn/Post-burn/Vegetation/Stone, artifactual/Site visibility.

Bellomo, R.

1991 Identifying Traces of Natural and Humanly-Controlled Fire in the Archaeological Record: the Role of Actualistic Studies. *Archaeology in Montana* 32(2):75-93.

Keywords: Archaeology/Archeology/Fire cycle/Fire, historical use of.

Bellomo, R. V., and J. W. K. Harris

1990 Preliminary Report of Actualistic Studies of Fire Within Virunga National Park, Zaire: Towards An Understanding of Archaeological Occurrences. In *Evolution of Environments and Hominidae in the African Western Rift Valley*, edited by N. T. Boaz, pp. 317-338. Memoir No. 1, Virginia Museum of Natural History, Martinsville.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Archaeomagnetic dating/Soil.

Bennett, P. S., and M. Kunzmann

1985 Effects of Heating on Artifacts: A Brief Report of Work Conducted at Western Archeological Center, Tucson. Ms. on file, National Park Service Co-operative Studies, University of Arizona, Tucson, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Obsidian/Ceramic, prehistoric/Ceramic, historic/Glass/Metal/Bone.

Benson, A.

1999a Effects of Fire on Obsidian Hydration Rind Thickness. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

1999b Effects of Low, Moderate, and Heavy Fuel Loads on Obsidian Hydration Rinds During a Prescribed Burn on the Tonopah Ranger District, Humbolt-Toiyabe National Forest. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. Draft on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Stone, artifactual/Obsidian/Obsidian hydration.

Biswell, H. H.

1967 The Use of Fire in Wildland Management in California. In *Natural Resources: Quality and Quantity*, edited by S. V. Ciriacy-Wantrup and J. J. Parsons, pp. 71-86. University of California Press, Berkeley.

Keywords: Burn management/Prescribed burn/Vegetation.

1989 Cultural Resources. In *Prescribed Burning in California Wildlands Vegetation Management*, pp. 213-220. University of California Press, Berkeley.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Fire suppression/Fire suppression, impact of/Prescribed burn/Prescription burn.

Blackburn, T. C., and K. Anderson

1993 *Before the Wilderness: Environmental Management by Native Californians*. Anthropological Papers No. 40. Ballena Press, Menlo Park, California.

Keywords: Fire, historical use of.

Blackwelder, E.

1927 Fire as an Agent in Rock Weathering. *Journal of Geology* 35:134-140. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Stone, structural/Erosion.

Bleed, P., and M. Meier

1980 An Objective Test of Effects of Heat Treatment of Flakable Stone. *American Antiquity* 45(3):502-507.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Bonnicksen, T. M.

2000 *America's Ancient Forests from the Ice Age to the Age of Discovery*. John Wiley & Sons, New York.

Key words: Fire, historical use of/Vegetation/Fire cycle.

Boyd, R.

1999 *Indians, Fires and the Land in the Pacific Northwest*. Oregon State University Press, Corvallis, Oregon.

Key words: Fire, historical use of/Fire cycle.

Brown, H.

2000 Wildland Burning by American Indians in Virginia. *Fire Management Today* 60(3):29-39. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of.

Brown, G. B., and L. Folb

1996 *West Mesa and Walnut Canyon Burn Archaeological Survey Report*. Anthropology Laboratories Report No. 1169. Northern Arizona University, Flagstaff. Submitted to U.S. Department of Interior, National Park Service, Order No. 1443PX747095147. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/ Archeology/Cultural resources/Fire effects/Site visibility/Vegetation.

Burgh, R. F.

1960 Potsherds and Forest Fires in the Pueblo Country. *Plateau* 33:54-65.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Ceramic,

prehistoric/C
eramic,
historic.

Cartledge, T.

1996 Heritage Resources and Fire Management: A Resource Management Crossroads. In *Fire Effects in the Southwestern Forests: Proceedings of the Second La Mesa Fire Symposium*, edited by C. D. Allen, pp. 206-214. General Technical Report RM-GTR-286, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Keywords: Fire effects/Archaeology/ Archeology/Cultural resources/Burn management/Fire suppression/Fire suppression, impact of.

Cavaoli, M.

1991 Fire Reveals New Pictographs at the Kuel Site: The Effects of Wildfire on Pictograph Sites. *Rock Art Papers* #27 8:81-83. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/ Archaeology/Cultural resources/Fire effects/Rock art.

Cole, S. J.

1997 *Documentation of Battleship Rock Petroglyph Site, MV2469, After the 1996 Soda Canyon Wild Fire*. Mesa Verde National Park, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/ Archaeology/Cultural resources/Fire effects/Rock art.

Colton, H. S.

1951 Hopi Pottery Firing Temperatures. *Plateau* 24(2):73-76.

Keywords: Archeology/Archaeology/Cultural resources/Fire effects/Ceramic,

historic/Ceramic,
prehistoric.

Connor, M. A., and K. P. Cannon

1991 Forest Fires as a Site Formation Process in the Rocky Mountains of Northwestern Wyoming. *Archaeology in Montana* 32(2):1-14. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Connor, M. A., K. P. Cannon, and D. C. Carlevato

1989 The Mountains Burnt: Forest Fires and Site Formation Processes. *North American Archaeologist* 10(4):293-310.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Surface effects/Subsurface effects/Stone, artifactual/Bone/Soil/Vegetation/Root burn.

Covington, W. W., and M. M. Moore

1994 Postsettlement Changes in Natural Fire Regimes and Forest Structure: Ecological Restoration of Old-Growth Ponderosa Pine Forests. In *Assessing Forest Ecosystem Health in the Inland West: Papers From the American Forests Workshop, November 14th-20th, 1993, Sun Valley, Idaho*, edited by R. N. Sampson and D. L. Adams, pp. 153-181. Hawthorn Press, New York.

Keywords: Fire suppression/Fire cycle/Fire, historical use of/Vegetation/Burn management.

Crespin, B.

1981 *Environmental Assessment Supplement - Cultural Resources, North Pinnacles Prescribed Burn*. Environmental Assessment No. CA-010-1-52, ARR No. CA-019-S-FS-127. US Bureau of Land Management. On file, Bureau of Land Management, Hollister Field Office, Hollister, California and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn.

Cummings, L. S.

1991 Pollen and Macrofloral Analysis at Nine Sites in Grand Teton National Park, Wyoming: 1988 Field Season. In *Jackson Lake Archeological Project: The 1987 and 1988 Field Work, vol. I*, by M. A. Connor, K. P. Cannon, S. E. Matz, D. C. Carlevato and C. A. Winchell, pp. 342-363. Midwest Archeological Center Technical Report No. 7. United States Department of the Interior, National Park Service, Lincoln. On file, Midwestern Archeological Center, Lincoln, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Pollen/Macrobotanical remains/Vegetation/Fire cycle.

Dandridge, D. E.

1999 Rock Art, Vegetation and Fire. *La Pintura* Spring 1999:4-5. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Rock art/Vegetation.

Davis, L., S. Aaberg, and A. Johnson
1992 Archeological Fieldwork at Yellowstone's Obsidian Cliff. *Park Science* Spring 1992:26-27. On file, Western Archeological Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Obsidian.

Davis, L. B., S. A. Aaberg, J. G. Schmitt, and A. M. Johnson
1995 *The Obsidian Cliff Plateau Prehistoric Lithic Source, Yellowstone National Park, Wyoming*. Selections from Division of Cultural Resources, Rocky Mountain Region No. 6. National Park Service, Denver. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Obsidian.

Deal, K.
1997 Fire Histories, Fuel Loads and Obsidian: Preliminary Results of a Prescribed Burn Experiment on the Eldorado National Forest. Paper presented at California Fuels Committee Meeting, Placerville, California. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire cycle/Prescribed burn/Stone, artifactual/Obsidian.

1999 Effects of Prescribed Fire on Obsidian and Implications for Reconstructing Past Landscape Conditions. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Obsidian/Obsidian hydration.

2001 Field Guide for Recording Fire Intensity, Fire Severity, and Fire Effects on Prehistoric Sites in the North-Central Sierras. In *Archaeological Investigations at Thirteen Sites with the Cleveland Fire, Pacific Ranger District, Eldorado National Forest*, Appendix D, by Krista Deal. On file, Supervisor's Office, Eldorado National Forest, Placerville, California.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Surface effects/Obsidian

Dean, J. C.
1999 *Condition Assessment of Three Rock Art Sites: Alibates Flint Quarries National Monument, Texas*. Dean & Associates Conservation Services, Portland. Prepared for Alibates Flint Quarries National Monument, Fritch, Texas. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Rock art/Post-burn.

DeBano, L. F., D. G. Neary, and F. Efolliett

1998 Cultural Resources. In *Fire Effects on Ecosystems*, pp. 266-283. Wylie and Sons, New York.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Donaldson, B.

1982 Response to CRMWO Information Request Dated 9/7/82 on Potential Fire Effects on Cultural Resources. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/ Archeology/Cultural resources/Fire effects.

DuBois, R. L.

1990 Appendix H. Archaeomagnetic Dating of Two Hearths in the La Mesa Fire Area. In *The 1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, p. 202. Southwest Cultural Resources Center Professional Papers No. 28. National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Archaeomagnetic dating.

Duncan, F. L.

1990 *Fire Effects and Cultural Resources: An Annotated Bibliography*. Long Mesa Fire Series Publication No. 2. Mesa Verde National Park Division of Research and Cultural Resource Management. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/Fire effects.

Edwards, J. L.

1995 *Cultural Resources Survey of High-Risk Areas Burned During the 1994 Fire Season, Fort Hunter Liggett Military Installation, Monterey County, California*. BioSystems Analysis, Santa Cruz, California. Submitted to U. S. Army Corps of Engineers, Sacramento District, Contract No. DACA05-90-C-0175. On file, Western Archeological & Conservation Center.

Keywords: Archaeology/ Archeology/Cultural resources/Fire effects/Burn management/Prescribed burn/Prescription burn.

Eininger, S.

1990 *Long Mesa Fire 1989, Archaeological Survey and Post Fire Assessment*. Produced by Mesa Verde Division of Research and Cultural Resource Management. On file, Division of Research and Cultural Resource Management, Mesa Verde National Park, Colorado, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Ceramic, prehistoric/Stone, artifactual/Stone, structural/Pollen/Macrobotanical remains/Fire suppression, impact of/Erosion/Vegetation/Soil/Emergency rehabilitation/ Thermoluminescence/ Archaeomagnetic dating/Dendrochronology.

Eisler, D., D. Parrella, and L. Spencer

1978 *Report on the Investigation and Analysis of Cultural Resources, Young's Butte Fire, Paulina Ranger District, Ochoco National Forest*. Submitted to Supervisor's Office, Ochoco National Forest, Prineville, Oregon. On file, Western Archeological and Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Soil/Erosion/Site visibility/Vandalism.

Elliott, M. L.

1998 *BAER Field Trip to Bandelier, a Case Study in Post-Fire Cultural Resource Site Rehabilitation: Site Number LA 115148*. Dome Fire Archeology Project, Bandelier National Monument, New Mexico. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Emergency rehabilitation.

Fenn, D. B., R. E. Kelly, and K. Davis

1980 *Research Proposal: Evaluation of Effects of Controlled Burning and Wildfires on Surface Archaeological Resources*. Western Region Committee on Effects of Fire on Archeological Resources, National Park Service. Submitted to Associate Regional Director, Resource Management and Planning, Western Region, National Park Service. On file, Western Archeological and Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Surface effects.

Fiero, K.

1991 *Post-Fire Archaeological Rehabilitation. Report on Stage II: Ruins Stabilization*. Long Mesa Fire Series, Division of Research & Cultural Resource Management, Mesa Verde National Park. On file, Division of Research & Cultural Resource Management, Mesa Verde National Park, Colorado, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Architecture.

Findlow, F. J., P. M. Martin, and J. E. Ericson

1982 An Examination of the Effects of Temperature Variation on the Hydration Characteristics of Two California Obsidians. *North American Archaeologist* 3(1):37-49.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Fish, S.

1989 *Long Mesa Fire: Fire Effects on Pollen: An Evaluation*. Division of Research & Cultural Resource Management, Mesa Verde National Park. On file, Division of Research & Cultural Resource Management, Mesa Verde National Park, Colorado.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Pollen.

Floyd-Hanna, L., A. DaVega, and W. H. Romme

1997 *Chapin 5 Fire Vegetation Monitoring and Mitigation: First Year Report*. Mesa Verde National Park. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Vegetation/Erosion/Emergency rehabilitation.

Floyd-Hanna, L., D. Hanna, and W. H. Romme

1998 *Chapin 5 Fire Vegetation Monitoring and Mitigation Annual Report, Year 2*. Mesa Verde National Park. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Vegetation/Erosion/Emergency rehabilitation.

Ford, R. I.

1990 Appendix B: Ethnobotanical Consequences of the La Mesa Fire, Bandelier National Monument. In *The 1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, pp. 147-152. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Macrobotanical remains/Soil/Charcoal/Vegetation.

Foster, D. G.

1989 CDF and the Laupenheimer Case: A Response to Ron May. *Society for California Archaeology Newsletter* 23(4):30. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Prescription burn/Burn management.

1991a Possible Adverse Effects to Cultural Resources During Prescribed-Fire Projects in California. USDA Forest Service. Ms. on file, California Department of Forestry and Fire Protection, Archaeology Office, Sacramento, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Prescription burn.

1991b *Prescribed Fire Incident Commander Training*. California Department of Forestry and Fire Protection, Unit 8, Cultural Resources. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Prescription burn/Burn management.

1994a *Archaeological Information Manual for CDF Prescribed Burn Managers*. California Department of Forestry and Fire Protection. On file, California Department of Forestry and Fire Protection, Archaeology Office, Sacramento, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Prescribed burn.

1994b *Recommended Procedures to Protect Archaeological and Historical Resources During a CDF Prescribed Burn Project*. California Department of Forestry and Fire Protection. On file, California Department of Forestry and Fire Protection, Archaeology Office, Sacramento, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Prescribed burn/Prescription burn.

1999 *Archaeological Review Procedures for VMP and CFIP Projects*. California Department of Forestry. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Burn management.

Fox, R. A., Jr.

1983 1983 Archaeological Investigations at Custer Battlefield National Monument. Ms. on file, Custer Battlefield National Monument, Crow Agency, Montana, and Midwestern Archeological Center, Lincoln.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Fire suppression, impact of/Artifact provenience/Looting/Vandalism.

Foxx, T. S.

1984 *La Mesa Fire Symposium - Proceedings*. LA-9236-NERP, Los Alamos National Laboratory, Los Alamos, New Mexico.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Vegetation/Soil.

Gavin, T. M.

1994 *Rincon Fire Burned Area Emergency Rehabilitation (BAER) Plan*. National Park Service (Western Region), South District BAER Team (#2), Pima County, Arizona. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Emergency rehabilitation/Archaeology/Archeology/Cultural resources/Fire effects/Fire suppression/Fire suppression, impact of/Fuel reduction/Soil/Vegetation.

Gleeson, P., and A. T. Jones

2000 Cultural Resource Protection and Federal Fire Management Issues. *Cultural Resource Management* 23(6):20-22. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/ Burn management/ Fire effects.

Green, D. F.

1980 *Managing Fire Effects Unit II C-2: Cultural Resources*. National Interagency Fire Training Center, USDA Forest Service. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

1999 Re-Hydrated Obsidian Projectile Points on the Warner Mountains, California. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Green, D. F., K. Bordwell, R. Hall, and A. Goheen

1997 *Effects of Prescribed Fire on Obsidian Hydration Rates*. USDA Forest Service, Warner Mountain Ranger District, Modoc National Forest. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Stone, artifactual/Obsidian/Obsidian hydration.

Gregg, M. L., and R. J. Grybush

1976 Thermally Altered Siliceous Stones from Prehistoric Contexts: Intentional vs. Unintentional Alteration. *American Antiquity* 41:189-192.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Griffiths, D. R., C. A. Bergman, C. J. Clayton, K. Ohnuma, G. V. Robins, and N. J. Seely

1987 Experimental Investigation of the Heat Treatment of Flint. In *The Human Uses of Flint and Chert: Proceedings of the Fourth International Flint Symposium, Held at Brighton Polytechnic, 10-15 April 1983*, pp. 43-52. Cambridge University Press, Cambridge.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Gruell, G. E.

1985 Indian Fires in the Interior West: A Widespread Influence. In *Proceedings- Symposium and Workshop on Wilderness Fire: Missoula, Montana, November 15-18, 1983*, edited by J. E. Lotan, B. M. Kilgore, W. C. Fischer, and R. W. Mutch, pp. 69-74. General Technical Report No. INT-182, USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Keywords: Fire, historical use of.

Halford, F. K., and A. S. Halford

1999 The Trench Canyon Prescribed Burn: An Analysis of Fire Effects on Archaeological Resources Within the Sagebrush Steppe Community. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Obsidian/Obsidian hydration/Pre-burn/Post-burn/Surface effects/Subsurface effects/Vegetation/Burn management/Prescribed burn.

Hanes, R.

1990 Archaeological and Historical Values. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Fire suppression, impact of/Prescribed burn/Erosion/Looting.

Hanson, Lisa S.

2001 *Predicting the Effects of Prescribed Burn Fire on Cultural Resource Visibility in Rocky Mountain National Park*. Unpublished Master's thesis, Colorado State University, Fort Collins, Colorado.

Keywords: Archaeology/Archeology/Cultural Resources/Fire effects/Pre-burn/Post-burn/Prescribed burn

Harris, A. H., and L. S. W. Porter

1990 Appendix E: Identification of Faunal Remains From LA 16114 in the La Mesa Fire. In *The 1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbell, N. Wood, and B. Fiedler, pp. 171-172. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Hemry, L.

1995 Appendix 3: Green Basin: Studying the Effects of Springtime Burns on Cultural Material. In *A Management Strategy and Study of Prescribed Burning Impacts on Heritage Resources in Ponderosa Pine/Douglas-Fir Composition Types on the Kootenai National Forest, Northwestern Montana*, edited by R. Timmons, pp. 1-10. USDA Forest Service, Northern Region, Missoula, Montana.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Vegetation.

Hemry, L., R. Timmons, R. Hvizdak, C. Webster, A. Thoms, and M. White

1996 *A Management Strategy and Study of Prescribed Burning Impacts on Heritage Resources in Ponderosa Pine/Douglas-Fir Composition Types on the Kootenai National Forest, Northwestern Montana*. USDA Forest Service, Northern Region, Missoula, Montana. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn.

Henderson, R. A., and S. H. Statz

1995 *Bibliography of Fire Effects and Related Literature Applicable to the Ecosystems and Species of Wisconsin*. Technical Bulletin 187. Wisconsin Department of Natural Resources, Madison. Available (Online): <<http://www.npwrc.usgs.gov/resource/literatr/firebibl/firebibl.htm>> [13 March 2001].

Keywords: Fire effects.

Hinshelwood, A.

1996 Boreal Forest Fire Ecology and Archaeological Site Formation: An Example from Northern Ontario. *Ontario Archaeology* 62:63-92. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire cycle/Soil/Artifact provenience.

Hopi Agency, Bureau of Indian Affairs, and Hopi Tribe

1998 *Keams Canyon Fire and Burned Area Emergency Rehabilitation (BAER) Plan*. Hopi Agency, Hopi Indian Reservation, Arizona. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Burn management/Erosion/Soil/Vegetation/Fuel reduction/Fire suppression, impact of.

House, J. H., and J. W. Smith

1975 Experiments in the Replication of Fire-Cracked Rock. In *The Cache River Archeological Project: An Experiment in Contract Archeology*, assembled by M. B. Schiffer and J. H. House. Research Series No. 8. Arkansas Archeological Survey, Fayetteville, Arkansas.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Hoyer, S. J.

1982 *The Effects of Prescribed Fire on Soil Properties*. On file, Supervisor's Office, Eldorado National Forest, Placerville, California, and Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Prescribed burn/Soil.

Hughes, R. E.

1984 Obsidian Sourcing Studies in the Great Basin: Problems and Prospects. In *Obsidian Studies in the Great Basin*, edited by R. E. Hughes, pp. 1-19. Contributions of the University of California Archaeological Research Facility No. 45, Department of Anthropology, University of California, Berkeley.

Keywords: Archaeology/Archeology/Cultural resources/Obsidian/Stone, artifactual.

Hull, K. L.

1991 *Archaeological Survey and Post-Fire Surface Evaluations of the Foresta, Big Meadow, and McCauley Meadow Areas, Yosemite National Park, California*. Publications in Anthropology 11. Yosemite National Park, Yosemite, California.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn.

Hull, K. L., and M. R. Hale

1993 *Post-Fire Archeological Survey of Devils Postpile National Monument, Madera County, California*. Dames and Moore, Chico, California. Submitted to Sequoia and Kings Canyon National Parks, California.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn.

Hunter, J.

1988 Prescribed Burning for Cultural Resources. *Fire Management Notes* 49(2):8-9. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Cultural resources/Prescribed burn/Burn management.

Ison, C.

ca.1990s Lesson Plan for "Fire Ecology From an Archaeological Perspective- an Eastern Woodland Example". Fire in Ecosystem Management Course, National Advanced

Resource Technology Center, Marana, Arizona. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Burn management/Fire, historical use of/Cultural resources.

Ison, C. R., and W. Sharp

1999 *Prehistoric Fire Activity and Forest Structure Along the Cumberland Plateau*. USDA National Forest Service, Jackson County, Kentucky. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of/Fire cycle/Burn management.

Jackson, R. J.

1984 Current Problems in Obsidian Hydration Analysis. In *Obsidian Studies in the Great Basin*, edited by R. E. Hughes, pp. 103-115. Contributions of the University of California Archaeological Research Facility No. 45, Department of Anthropology, University of California, Berkeley.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Obsidian/Obsidian hydration.

1998 *Prescribed Fire and the Protection of Heritage Resources: A Heritage Resources Management Module*. Pacific Legacy. Prepared for USDA Forest Service, Pacific Southwest Region (Region 5), National Forests of the Sierra Nevada, Contract Number 43-9A23-3-0592. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Prescribed burn/Post-burn/Vegetation/Site visibility.

James, S. R.

1989 Hominid Use of Fire in the Lower and Middle Pleistocene: A Review of the Evidence. *Current Anthropology* 30:1-27. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of.

Johnson, A.

1991 Post-fire Identification of Nineteenth Century Wooden Structures. *Archaeology in Montana* 32(2):33-48. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural Resources/Fire effects/Wood, structural/Post-burn.

Johnson, A. M., and K. A. Lippincott

1989 *1988 Post-Fire Archaeological Assessment, Prehistoric Sites, Yellowstone National Park*. National Park Service, Denver. On file, National Park Service Rocky Mountain Regional Office, Denver, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Fire suppression, impact of/Looting/Vandalism/Soil/Stone, artifactual/Stone, structural.

Johnson, J. S., J. Clark, S. Miller-Antonio, D. Robins, M. B. Schiffer, and J. M. Skibo

1988 Effects of Firing Temperature on the Fate of Naturally Occurring Organic Matter in Clays. *Journal of Archaeological Science* 15:403-414. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Ceramic, prehistoric/Soil.

Jones, A. T., and, K. C. Ryan (editors)

ca. 2001 *Wildland Fire in Ecosystems: Effects of Fire on Cultural Resources and Archeology*. General Technical Report No. RMRS-GTR-42-vol.3. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/ Fire effects/ Burn management/ Ceramic, prehistoric/ Ceramic, historic/ Glass/ Metal/ Obsidian/ Rock art/ Root burn/ Stone, artifactual/ Subsurface effects/ Surface effects.

Jones, A. T., and R. C. Euler

1986 Effects of Forest Fires on Archaeological Resources at Grand Canyon National Park. *North American Archaeologist* 7:243-254. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Fire effects/Ceramic, prehistoric/Prescribed burn/Post-burn/Fire cycle/Stone, artifactual/Stone, structural.

Katz, S., and P. Katz

1998 *Archeological Survey and Resource Damage Assessment Resulting From the Construction of Fire Suppression Lines at the Site of the Palo Duro Fire, Potter and Moore Counties, Texas*. PRIAM Project No. 9818. Lake Meredith National Recreation Area and Alibates Flint Quarries National Monument, Fritch, Texas. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire suppression, impact of/Fire suppression.

Keefe, T. M., B. M. Kahl, and S. T. Montague

1998 *The Ackerson Post-Fire Archeological Project, Yosemite National Park, California*, vol. 1 draft. Yosemite Research Center, Yosemite National Park. On file, Archaeology Office, Yosemite National Park, California, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Post-burn.

Kelly, R. E.

1981 Tentative Results of Research Regarding Fire Impacts Upon Archeological Resources: Western Region, N.P.S. Paper presented at Prescribed Fire Workshop, Yosemite National Park, California. On file, National Park Service Western Regional Office, San Francisco, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Fire suppression, impact of/Fire, historical use of.

1984a References Dealing With Aboriginal Terrain Fires and Effect of Fires Upon Archaeological Resources. Compiled for A Burning Issue? Effects of Fire on Archeological Resources Symposium, Annual Meeting of the Society for American Archeology, Portland. On file, National Park Service Western Regional Office, San Francisco, and Western Archeological and Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire, historical use of/Fire cycle.

1984b Spurious and Real Relationships of Field and Laboratory Data in Fire Effects Studies. Paper presented at the Annual Meeting of the Society for American Archaeology, Portland. Draft on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Fire, historical use of/Fire suppression, impact of.

1987 To Burn or Not to Burn: The Challenge of Cultural Resources. Paper presented at Kings River Community College "Introduction to Fire Effects" class, Reedley, California. On file, Western Archeological & Conservation Center, Tucson, and National Park Service, Western Regional Office, San Francisco.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Fire suppression, impact of/Soil.

1989 The Arrowhead and Tin Can Factor: Effects of Fire on Heritage Resources. Training course outline for Fire Effects Training Course, TFM Module IV, May 10, 1989, Seattle. Ms. on file, Western Archeological & Conservation Center, Tucson and National Park Service, Western Regional Office, San Francisco.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

1991 Lecture Notes from Fire Effects USFS/Washington Institute Class. Ms. on file, Western Archeological & Conservation Center, Tucson, and National Park Service Western Regional Office, San Francisco.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire suppression, impact of.

1999 An Overview of Obsidian Studies Within Western U.S. Parks. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Kelly, R. E., and J. Mayberry

1980 Trial by Fire: Effects of NPS Burn Programs Upon Archaeological Resources. In *Proceedings of the Second Conference of Scientific Research in National Parks*, vol. 1, pp. 603-610. Special Addresses Anthropology Report No. NPS/ST-80/02-1. National Park Service, Washington, D.C

Keywords: Archaeology/cultural resources/Fire effects/Burn management.

Keter, T. S.

1995 Fire History of the North Fork Basin. In *Environmental History and Cultural Ecology of the North Fork of the Eel River Basin, California*, pp. 5-7. Report No. R5-EM-TP-002.

Submitted to USDA Forest Service, Six Rivers National Forest, Eureka, California.

Keywords: Fire cycle/Fire effects/Fire, historical use of/Fire suppression/Vegetation.

Keyser, J. D.

1983 Prescribed Fire Management, Unit IIB3: Visual and Cultural Resources, National Advanced Resource Technology Center Training Course, 2/28-3/4/83, Marana, Arizona. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Prescribed burn.

Kight, B.

1992 *Fire Effects on Colorado BLM Cultural Resources (Draft)*. Bureau of Land Management, Glenwood Springs Resource Area, Glenwood Springs, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/Fire effects/Vegetation.

Kolber, J.

1998 Burned Petroglyphs in Deadman Wash. *La Pintura* 24(4):1-2. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Rock art/Post-burn.

Krammes, J. S.

1990 *Effects of Fire Management of Southwestern Natural Resources: Proceedings of the Symposium, November 15-17, 1988, Tucson, AZ*. General Technical Report No. RM-191. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Keywords: Fire effects/Cultural resources.

Lentz, S. C., J. K. Gaunt, and A. J. Willmer

ca. 1994 *A Summary of a Study of the Effects of Fire on Archaeological Resources, Phases I and II*. Office of Archaeological Studies, Museum of New Mexico, Santa Fe. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Cultural resources/Jemez Mountains/Henry Fire/Prescribed burn/Fire effects/Archaeology.

1996 *Fire Effects on Archaeological Resources, Phase I: The Henry Fire, Holiday Mesa, Jemez Mountains, New Mexico*. General Technical Report No. RM-GTR-273. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Cultural resources/Jemez Mountains/Henry Fire/Prescribed burn/Fire effects/Archaeology.

Lewis, H. T.

1973 Patterns of Indian Burning. *Ballena Press Anthropological Papers* No. 40. Ballena Press, Menlo Park, California.

Keywords: Fire, historical use of/Fire cycle.

1980 Hunters-Gatherers and Problems for Fire History. In Proceedings of the Fire History Workshop, 1980, Tucson, Arizona. General Technical Report No. RM-81. USDA Forest Service, Fort Collins, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire cycle/Fire, historical use of.

Linderman, C. A.

1992 *The Effects of Fire on Obsidian Artifacts: A Problem in Hydration Dating in a Woodland Environment*. Unpublished senior honors paper, Department of Anthropology, University of Oregon, Eugene.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Linderman, C. A., and E. O. Bergland

1991 *The Effects of Fire on Obsidian Artifacts: 1989 Regional Forester's Challenge Grant Study*. USDA Forest Service, Pacific Northwest Region, Willamette National Forest, McKenzie Ranger District, McKenzie Bridge, Oregon. On file, McKenzie Ranger District, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual/Obsidian/Obsidian hydration/Prescribed burn/Subsurface effects.

Lintz, C.

1989 Experimental Thermal Discoloration and Heat Conductivity Studies of Caliche from Eastern New Mexico. *Geoarchaeology* 4:319-346. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Soil/Fire effects.

Lissoway, J.

1986 Fire and Resources Management, Unit III-C: Cultural Resources Management. In *National Advanced Resource Technology Center Training Course, 3/17-28/86, Marana*, pp. 1-23. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management.

Lissoway, J., and J. Propper

1990 Effects of Fire on Cultural Resources. In *Effects of Fire Management of Southwestern Natural Resources: Proceedings of the Symposium, November 15-17, 1988, Tucson, AZ*, edited by J. S. Krammes, pp. 1-10. General Technical Report No. RM-191, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Post-burn/Bone/Ceramic, prehistoric/Pollen/Stone, artifactual/Stone, structural/Obsidian/Macrobotanical remains/Fire suppression, impact of.

Look, D. W.

1999 The Sensitive Retrofit of Historic Buildings: Risk Management. In *1997 Kobe/Tokyo International Symposium on Risk Preparedness for Cultural Properties: Development of Guidelines for Emergency Response*, edited by H. Saito, pp. 201-214. Chuo-Koron Bijutsu Shuppan, Japan. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Fire Effects/Cultural Resources/Fuel reduction.

Lotan, J. E., M. E. Alexander, S. F. Arno, R. E. French, O. G. Langdon, R. M. Loomis, R. A. Norum, R. C. Rothermel, W. C. Schmidt, and J. V. Wagtendonk

1981 *Effects of Fire on Flora: A State-of-Knowledge Review, National Fire Effects Workshop, Denver*. General Technical Report No. WO-16. USDA Forest Service, Washington, D.C. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Vegetation.

Lotan, J.E., B.M. Kilgore, W.C. Fischer, and R.W. Mutch

1985 *Symposium and Workshop on Wilderness Fire, 1983, Missoula, Montana*. General Technical Report No. INT-182. USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah.

Keywords: Fire effects/Burn management.

Loyd, J.

1999 Rehydration of Burned Obsidian. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian hydration/Obsidian/Stone, artifactual.

Luedtke, B. E.

1992 *An Archaeologist's Guide to Chert and Flint*. Archaeological Research Tools Vol. 7. Institute of Archaeology, University of California, Los Angeles.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Lyon, L. J., H. S. Craford, E. Czuhai, R. L. Fredriksen, R. F. Harlow, L. J. Metz, and H. A. Pearson

1978 *Effects of Fire on Fauna: A State-of-Knowledge Review, National Fire Effects Workshop, Denver*. General Technical Report No. 6. USDA Forest Service, Washington, D.C. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects.

MacCleery, D.

1994 *Understanding the Role the Human Dimension Has Played in Shaping America's Forest and Grassland Landscapes: Is There a Landscape Archaeologist in the House?* Eco-Watch Forest Service Policy Dialogues Forum. Available (Online):

<<http://www.fs.fed.us/eco/eco-watch/ew940210.htm>> [10 April 2001]. Ms. (accessed 14 January 2000) on file, Western Archeological & Conservation Center, Tucson.
Keywords: Fire, historical use of/Archeology/Archaeology/Cultural resources/Fire effects.

Maloney, E. R., and B. I. Zimple

1997 *Archeological Site Hazardous Fuel Assessment Program: Final Comprehensive Report*. Archeological Site Hazard Fuels Assessment Program (ASHFAP), National Park Service. Submitted to Fire Management Officer, National Park Service Intermountain Region, Denver. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Burn management/Fire effects/Fuel reduction.

1998 *Guadalupe Mountains National Park: Archeological Site Hazardous Fuel Assessment Report*. Archeological Site Hazard Fuels Assessment Program (ASHFAP), National Park Service. Submitted to Superintendent, Guadalupe Mountains National Park, New Mexico. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archeology/Archaeology/Cultural resources/ Fire effects/ Burn management/ Fuel reduction.

2000 *Environmental Assessment: Hazard Fuel Reduction Plan, High Risk Archeological Sites*. National Park Service, Mesa Verde National Park, Colorado. On file, Mesa Verde National Park Research Center, and Western Archeological & Conservation Center, Tucson.
Keywords: Archeology/Archaeology/Cultural resources/Fire effects/Fuel reduction.

Mandeville, M. D.

1973 A Consideration of the Thermal Pretreatment of Chert. *Plains Anthropologist* 18:177-202. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Manuel, D.

1980 *Prescribed Burning and Its Effects on Cultural Resources Within the Diablo and Sierra De Salinas Mountain Ranges of the Interior Central Coast of California: Initial Investigations*. Bureau of Land Management, Folsom District, Susanville, California. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn.

Martinez, D.

1993 Back to the Future: Ecological Restoration, the Historical Forest, and Traditional Indian Stewardship. Paper presented at A Watershed Perspective on Native Plants Conference, Olympia, Washington. On file, Western Archeological & Conservation Center, Tucson.
Keywords: Fire, historical use of.

May, R. V.

1989 Conservation Law and Archaeology. *Society for California Archaeology Newsletter* 23(3):29. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Fire effects/Prescribed burn/Prescription burn.

Mazer, J. J., C. M. Stevenson, W. L. Ebert, and J. K. Bates

1991 The Experimental Hydration of Obsidian as Function of Relative Humidity and Temperature. *American Antiquity* 56(3):504-513.

Keywords: Archaeology/Archeology/Cultural resources/Obsidian/Obsidian hydration/Stone, artifactual.

McAuliffe, J.

1997 Burning Issues in the Sonoran Desert. *Bajada* 5(2):12-13. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Vegetation.

McDowell-Loudan, E. E.

1983 Fire-cracked Rock: Preliminary Experiments to Determine its Nature and Significance in Archaeological Contexts. *Chesopiean* 21(1):20-29.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

McIntyre, M. J.

ca. 1984 Fire Effects - Cultural Resources. Lesson plan for Prescribed Fire Plan Development Course, National Advanced Resource Technology Center, Marana, Arizona. On file, Western Archeological and Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Burn management.

McParland, P.

1977 Experiments in the Firing and Breaking of Rocks. *Calgary Archaeologist* 5:31-33.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Melcher, C. L., and D. K. Zimmerman

1977 Thermoluminescent Determination of Prehistoric Heat Treatment of Chert Artifacts. *Science* 197:1359-1362.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Mesa Verde National Park Burned Area Emergency Rehabilitation Team

2000 *Chapin #5 Fire: Burned Area Emergency Rehabilitation Accomplishment Report*. National Park Service, Mesa Verde National Park, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Emergency rehabilitation.

Morris, S.

1992 Wildfire as a Part of Cultural Prehistory in Montana and the Implications for Public Land Managers. *Archaeology in Montana* 33(1):79-90. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Burn management/Fire, historical use of.

Moskowitz, K.

1988 *Flat Fire Section 110 Project*. Forest Service Report No. TY-98-1254. USDA Forest Service, Humbolt-Toiyabe National Forests, Nevada. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Nakazawa, Y.

1999 Thermal Alteration of Obsidian: Experiments, Classification and Method for Detection. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento, California. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

National Interagency Fire Center (NIFC)

1995 Unit 4A, Cultural Resources. In *Introduction to Fire Effects RX340 Student Text*. National Interagency Fire Center, Boise, Idaho.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Stone, artifactual/Stone, structural/Ceramic, historic/Ceramic, prehistoric/Vegetal, artifactual.

1997 *Joint Fire Science Program*. Prepared by Joint Fire Science Plan Drafting Committee.

Available (Online): <http://www.nifc.gov/joint_fire_sci/JointFire.html> [13 March 2001]. Ms. (accessed 30 October 1998) on file, Western Archeological & Conservation Center, Tucson.

Keywords: Burn management/Fire suppression/Fuel reduction/Fire effects/Fuel reduction/Prescribed burn/Preventative treatment/Vegetation.

National Park Service

1988 *Management Policies*. National Park Service, General Printing Office, Washington, D.C.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management.

2000 Cultural Resources Protection and Fire Management Planning. Course held at the Western Archeological and Conservation Center, Tucson. Sponsored by the Stephen T. Mather Training Center, Harpers Ferry, West Virginia. Course workbook on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management.

Newsome, D. K., R. I. Birnie, B. L. Tipps, and G. H. Miller

1988 *The Simnasho Fire Project: Cultural Resources Inventory, Assessment, and Testing on the Warm Springs Reservation of Oregon*. P-III Associates, Salt Lake City. Submitted to Bureau of Indian Affairs, Portland, and Confederate Tribes of the Warm Springs Reservation, Oregon. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Fire suppression, impact of/Architecture/Erosion/Soil/Subsurface effects/Surface effects/Vegetation.

Noxon, J. S., and D. A. Marcus

1983 Wildfire-Induced Cliff Face Exfoliation and Potential Effects on Cultural Resources in the Needles District of Canyonlands National Park, Utah. *Southwestern Lore* 49(2):1-8. On file, Western Archeological & Conservation Center, Tucson

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Rock art/Stone, structural.

Oppelt, N. I., and T. J. Oliverius

1993 The Effects of Fire Retardant Foam on Prehistoric Potsherds. *Southwestern Lore* 59(1):26-30. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire suppression, impact of/Ceramic, prehistoric.

Origer, T., and J. Anderson

1994 Preliminary Results on an Assessment of the Effects of Fire on Obsidian Specimens from CA-SON-48, Salt Point State Park, Sonoma County, California. *International Association for Obsidian Studies Newsletter* 12:3-4.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Stone, artifactual.

Parsons, D. J.

1994 Prescribed Fire: Current Status and Future Directions. *Park Science* 14(2):26. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Prescribed burn/Burn management/Fire effects.

Patterson, L.

1995a Thermal Damage of Chert. *Lithic Technology Journal* 20(1):72-80. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

1995b Intentional Heat Treatment: A Reply to Rondeau. *Lithic Technology Journal* 20(2):136-137. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Perkins, L. R. I.

1985 Experiments in Heat-treating West-Central Mississippi Chert. *Mississippi Archaeology* 20(1):19-40. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Fire effects/Stone, artifactual.

Phillips, B. G.

1997 *History of Fire and Fire Impacts at Tonto National Monument, Arizona*. Technical Report No. 59. U.S. Geological Survey, Tucson. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Vegetation/Fire effects.

Picha, P. R., S. A. Ahler, R. D. Sayler, and R. W. Seabloom

1991 Effects of Prairie Fire on Selected Artifact Classes. *Archaeology in Montana* 32(2):15-28.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Post-burn/Pre-burn/Vegetation/Stone, artifactual/Ceramic, prehistoric/Glass/Wood, artifactual/Charcoal/Shell.

Pidanick, B.

1982 Prescribed Fire/Cultural Artifacts, Investigating the Effects. *Pacific/Southwest Log* October:4-5. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Bone/Glass/Shell/Stone, artifactual/Surface effects/Subsurface effects.

Pierce, C.

1984 Analysis of Cooking Stones From a Late Period Chumash Village. Paper presented at the 49th Annual Meeting of the Society for American Archaeology, Portland. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Pilles, P. J.

1982 Prescribed Fire Management and Cultural Resource Management. Paper presented at Prescribed Fire Management Training Course, May 4-5, National Interagency Fire Training Center, Marana, Arizona.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Emergency rehabilitation/Fire suppression, impact of/Ceramic, prehistoric/Wood, structural/Stone, artifactual/Pollen/Surface effects/Subsurface effects/Root burn.

1984 The Effects of Forest Fires on Archaeological Sites. Paper presented at the 49th Annual Meeting of the Society for American Archaeology, Portland. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Emergency rehabilitation/Stone, structural/Architecture.

Powell, D. W.

1987 Wildfire Effects on Cultural Resource Sites and Their Management. Paper presented at the Northwest Anthropological Conference, Gleneden, Oregon. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Artifact provenience/Erosion/Root burn/Wood, structural/Architecture.

Purdy, B. A.

1974 Investigations Concerning the Thermal Alteration of Silica Minerals: An Archaeological Approach. *Tebiwa* 17(1):37-66.

Keywords: Archaeology/Cultural resources/Fire effects/Stone, artifactual.

Purdy, B. A., and H. K. Brooks

1971 Thermal Alteration of Silica Minerals: An Archaeological Approach. *Science* 173:322-325.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Pyne, S. J.

1997 *Fire in America: A Cultural History of Wildland and Rural Fire*. Reprinted. Weyerhaeuser Environmental Books, University of Washington Press, Seattle. Originally published 1982, Princeton University Press, Princeton.

Keywords: Fire, historical use of.

1998 Pyre on the Mountain. In *Reopening the American West*, edited by H. Rothman, pp. 38-52. University of Arizona Press, Tucson.

Keywords: Fire cycle/Fire, historical use of/Fire suppression.

2000 Where Have All the Fires Gone? *Fire Management Today* 60(3):4-7. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of.

Racine, C. H., and M. M. Racine

1979 Tundra Fires and Two Archaeological Sites in the Seward Peninsula, Alaska. *Arctic* 32(1):76-79. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Pre-burn/Post-burn/Site visibility/Vegetation/Stone, structural/Bone.

Rick, J. W.

1978 *Heat-Altered Cherts of the Lower Illinois Valley, an Experimental Study in Prehistoric Technology*. Prehistoric Records No. 2. Archaeology Program, Northwestern University, Evanston, Illinois.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Ridings, R.

1991 Obsidian Hydration Dating: the Effects of Mean Exponential Ground Temperature and Depth of Artifact Recovery. *Journal of Field Archaeology* 18:77-85.

Keywords: Archaeology/Archeology/Cultural resources/Obsidian/Obsidian hydration/Stone, artifactual.

Roberts, J. E.

1985 Protection of Archaeological Sites and Special Areas During Prescribed Burning. *Fire Management Notes* 46(3):9-10. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Burn management/Cultural resources/Preventative treatment.

Robins, G. V., N. J. Steely, D. A. C. McNeil, and M. R. C. Symons

1978 Identification of Ancient Heat Treatment in Flint Artifacts by ESR Spectroscopy. *Nature* 276:703-704. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Architecture/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Robinson, W. J.

1990 Appendix A: Tree Ring Samples and Dated Fire Scars on Eight Trees From the La Mesa Fire Area. In *The 1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, pp. 142-146. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire cycle.

Rogers, A. B., and C. M. Francis

1988 Fire Effects on Prehistoric Sites: Hot Today, Gone Tamale. Paper presented at the Annual Meeting of the Society for California Archaeology, Redding.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Post-burn/Artifact provenience/Artifact provenience/Erosion/Soil.

Romme, W. H., L. Floyd-Hanna, and M. Connor

1993 Effects of Fire on Cultural Resources at Mesa Verde NP. *Park Science* Summer:28-30. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Preventative treatment.

Rondeau, M. F.

1995 Thermal Damage Does Not Equal Heat Treatment. *Lithic Technology Journal* 20(2):135-136.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Rowlett, R. M.

1986 Ancient Fires at Koobi Fora. Paper presented at The Longest Human Record: The Human Career in Africa, A Conference in Honor of J. Desmond Clark, Berkeley. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

1991 Ancient Grass Fires Detected by Thermoluminescence. *Archaeology in Montana* 32(2):29-32. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Thermoluminescence.

1991 Ceramic Thermoluminescence Response Effects After the La Mesa Forest Fire, Bandelier National Monument. *Archaeology in Montana* 32(2):49-56. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Thermoluminescence/Ceramic, prehistoric/Post-burn.

Rowlett, R. M., M. G. Davis, and R. B. Graber

1999 Friendly Fire: The First Campsites Helped Hominids Survive the Night. *Discovering Archaeology* Sept./Oct.(5). On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Fire effects/Cultural resources.

Rowlett, R. M., and S. Johannessen

1990 Appendix G: Thermoluminescence Response Interference From the La Mesa Forest Fire, Bandelier National Monument. In *The 1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, pp. 178-188. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Ceramic, prehistoric/Thermoluminescence/Subsurface effects/Surface effects.

Rowney, M., and J. P. White

1997 Detecting Heat Treatment of Silcrete: Experiments with Methods. *Journal of Archaeological Science* 24:649-657. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Fire effects/Stone, artifactual.

Ruscavage-Barz, S. M.

1999 *Fire in the Hole: The Effects of Fire on Subsurface Archaeological Materials (Draft)*. National Park Service, Bandelier National Monument, New Mexico. Ms. on file, Bandelier National Monument, New Mexico, and Western Archeological & Conservation Center, Tucson. .

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Subsurface effects/Bone/Carbon 14/Ceramic, prehistoric/Archaeomagnetic dating/Dendrochronology/Obsidian/Pollen.

Ryan, K.

2001 Evaluating Fire Effects on Cultural Resources. Paper presented at Cultural Resources Protection and Fire Management Planning training course, Western Archeological and Conservation Center, Tucson. Sponsored by Stephen T. Mather Training Center, Harpers Ferry, West Virginia. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Burn management/Cultural resources/Fire effects.

Sampson, M.

1994 Preliminary Assessments of Effects from the Southern California Fires Upon Archaeological Sites. *Society for California Archaeology Newsletter* 28(1). On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Sanberg, D. V., J. M. Pierovich, D. G. Fox, and E. W. Ross

1979 *Effects of Fire on Air: A State-of-Knowledge Review, National Fire Effects Workshop, Denver*. General Technical Report WO-9. USDA Forest Service, Washington, D.C. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects.

Sayler, R. D., R. W. Seabloom, and S. A. Ahler

1989 *Impacts of Prescribed Burning on Archaeological and Biological Resources of the Knife River Indian Villages NHS*. Prepared by Institute for Ecological Studies, Department of Biology and Department of Anthropology, University of North Dakota, Grand Forks. Submitted to National Park Service, Contract No. PX 1200-8-0833. On file, Knife River Indian Villages National Historic Site, North Dakota.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Vegetation/Subsurface effects/Surface effects.

Schindler, D. L., J. W. Hatch, C. A. Hay, and R. C. Bradt

1972 Aboriginal Thermal Alteration of a Central Pennsylvania Jasper: Analytical and Behavioral Implications. *American Antiquity* 47:526-544.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Schroder, S. A.

1999 A Synthesis of Previous Studies That Explored the Effects of Fire on Obsidian: Where We've Been and Where We're Going. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration.

Schub, L.

1998 *Stonewall Fire Cultural Resources Damage Assessment Project, Pinnacles National Monument*. National Park Service, Western Archeological & Conservation Center, Tucson. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/Fire effects/Emergency rehabilitation/Post-burn.

Schuster, L. C.

1992 *Bulldozers and Archaeology at John Young's Homestead: Archaeology at Pu'Ukohola Heiau National Historic Site*. National Park Service, Honolulu. On file, National Park Service, Pacific Area Office, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire suppression, impact of/Architecture.

Scott, D. D.

1979 *Don't Burn That Wickiup! A Value at Risk. Some Considerations of Cultural Resources in Fire Management*. Bureau of Land Management, Montrose, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Prescribed burn/Ceramic, prehistoric/Glass/Metal/Stone, artifactual/Stone, structural/Vegetal, artifactual/Rock art/Wood, structural/Architecture.

1989 *Evaluation of Cultural Resources Affected by the Red Bench Fire, Glacier National Park*. National Park Service, Lincoln. On file, Midwest Archeological Center, Lincoln, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn.

Scott, L. J.

1990 Appendix C: Pollen Analysis of Three Sites in the La Mesa Study Area. In *The 1977 La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, pp. 153-164. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Pollen/Subsurface effects/Surface effects.

Seabloom, R. W., R. D. Sayler, and S. A. Ahler

1991 Effects of Prairie Fire on Archeological Artifacts. *Park Science* 11(1):1,3. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Shackley, M. S., and C. Dillon

1999 Thermal and Environmental Effects on Obsidian Geochemistry: Experimental and Archaeological Evidence. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Shepard, A. O.

1939 Appendix A: Technology of La Plata Pottery. In *Archaeological Studies in the La Plata District, Southwest Colorado and Northwest New Mexico*, by E. H. Morris, pp. 249-288. Publication 519. Carnegie Institute of Washington, Washington, D.C.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Ceramic, prehistoric.

1956 *Ceramics for the Archaeologist*. Publication No. 609. Carnegie Institution of Washington, Washington, D.C.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Ceramic, historic/Ceramic, prehistoric.

Shipman, P., G. Foster, and M. Schoeninger

1984 Burnt Bones and Teeth: An Experimental Study of Color, Morphology, Crystal Structure, and Shrinkage. *Journal of Archaeological Science* 11:307-325.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Bone.

Shoemaker, K. W.

1975 *Selected Bibliography of Studies in Soil Ecology With Emphasis on the Influence of Fire on Soil*. National Park Service, Grand Canyon National Park, Arizona. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Soil.

Siefkin, N.

1999a *Cultural Resource Management and Prescribed Fire at Lassen Volcanic National Park, Lava Beds National Monument, and Whiskeytown National Recreation Area*. National Park Service, Redwood National Park. On file, Redwood National Park, Arcata Office, California, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management.

1999b Manual Fuel Load Reduction as a Means of Reducing the Effects of Fire on Obsidian Hydration: An Example From Lassen Volcanic National Park. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fuel reduction/Obsidian/Obsidian hydration/Stone, artifactual.

Siefkin, N., and P. Brunmeier

1999 Coping With Conflagrations: The 1999 Archeological Prescribed Fire Survey at Lava Beds National Monument. Paper presented at the 1999 Northern Data Sharing Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Obsidian/Obsidian hydration/Stone, artifactual.

Silvermoon, J. M.

1987 *Effects of Fire on Cultural Resources: A Review of the Literature*. Willamette National Forest, McKenzie Bridge, Oregon. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian.

Skinner, C. N.

1999 Fire Regimes and Fire History: Implications for Obsidian Hydration Dating. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire cycle.

Smith, J. E.

1990 Impacts of Wildfire on Archaeological Sites at Mesa Verde National Park. Paper presented at the Annual Meeting of the Society for American Archaeology, Las Vegas. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Fire suppression, impact of/Erosion/Stone, artifactual/Stone, structural/Ceramic, prehistoric.

Smith, J.

1999 Protecting Archaeological Sites with Prescribed Fire. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Prescribed burn/Preventative treatment.

Solomon, M.

1999 Fire and Glass: The Effects of Prescribed Burning on Obsidian Hydration Bands. Paper presented at the Annual Meeting of the Society for California Archaeology, Sacramento. Presentation notes on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Spoerl, P. M.

1988 Management Impacts on Cultural Resources: An Assessment of Forest Service Research Needs. In *Tools to Manage the Past: Research Priorities for Cultural Resources in the Southwest, Symposium Proceedings, May 2-6, 1988, Grand Canyon, Arizona*, edited by J. A. Tainter and R. H. Hamre, pp. 17-25. General Technical Report No. RM-164. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management.

Steffen, A.

1999 When Obsidian Goes Bad...: Forest Fire Effects on Jemez Obsidian. Poster paper presented at the Annual Meeting of the Society for American Archaeology, Chicago. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Stone, artifactual.

Stehli, I.

1990 Appendix I: Radiocarbon Dates From the Sites Burned by the La Mesa Fire. In *The La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, pp. 203-206. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Carbon 14/Wood, structural.

Stevenson, C. M., J. Carpenter, and B. E. Scheetz

1989 Obsidian Dating: Recent Advances in the Experimental Determination and Application of Hydration Rates. *Archaeometry* 31(2):193-206.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration.

Stevenson, M. C., J. K. Bates, T. A. Abrajano, and B. E. Scheetz

1989 Obsidian and Basaltic Glass Dating Require Significant Revision of High Temperature Rate Development Methods. *Society for Archaeological Sciences Bulletin* 12(1):3-5.

On file, Western Archeological and Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Swan, L.

1987 Fires Suppression and Cultural Resources. Working paper prepared for training module. Ms. on file, Western Archeological and Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Fire suppression/Fire suppression, impact of.

1989 Fire/Archaeology Update. USDA Forest Service, California Region. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management.

1990 Dozer Supervisor Training Course. Resource Protection, Specifically Cultural Resource Protection Unit. USDA Forest Service, California Region. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archeology/Burn management/Fire suppression.

Swan, L., and C. Francis

1989 Fire and Archaeology, Abstract and Poster Session. In *Proceedings of the Symposium on Fire and Watershed Management, October 26-28, 1988, Sacramento, California*, edited by Neil H. Berg, p. 156. General Technical Report No. PSW-109. USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkeley.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Fire suppression/Emergency rehabilitation.

1991 Fire and Archaeology. *Fire Management Notes* 52(1):21. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Swetnam, T., C. H. Baisan, P. M. Brown, and A. C. Caprio

1989 *Fire History of Rhyolite Canyon, Chiricahua National Monument*. Technical Report No. 32. Cooperative National Park Resources Studies Unit, School of Renewable Natural Resources, University of Arizona, Tucson. Prepared for National Park Service, Western Region, San Francisco.

Keywords: Fire cycle/Vegetation.

Switzer, R. R.

1974 The Effects of Forest Fire on Archaeological Sites in Mesa Verde, National Park, Colorado. *The Artifact* 12(3):1-8. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn.

Sydoriak, C., E. Matic, M. Elliott, and E. Ruby

1988 *1996 Dome Fire Emergency Fire Rehabilitation: A Draft Report*. National Park Service, Bandelier National Monument. On file, Bandelier National Monument, New Mexico, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Erosion/Soil/Vegetation/Fuel reduction/Fire suppression, impact of.

Sydoriak, C., and E. Ruby

1998 A Model for Assessing and Treating Cultural Resource Sites Damaged by Wildfires in the Southwest Using Federal Emergency Fire Rehabilitation Funds (Draft Report). National Park Service, Bandelier National Monument. Ms. on file, Bandelier National Monument, New Mexico, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation.

Sydoriak, C., E. Ruby, and E. Mozzillo

1997 Emergency Wildfire Damage Assessments for Cultural Resource Site Treatments. National Park Service, Bandelier National Monument, New Mexico. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation.

Tainter, J. A., and R. H. Hamre

1988 *Tools to Manage the Past: Research Priorities for Cultural Resources Management in the Southwest, Symposium Proceedings, May 2-6, 1988, Grand Canyon, Arizona*. General Technical Report No. RM-164. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management.

Tamez, S.

1978 *Effects of the La Mesa Fire on Bandelier's Cultural Resources -Draft*. National Park Service, Bandelier National Monument. Ms. on file, Bandelier National Monument, New Mexico.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn.

Tamez, S., and P. A. Connors

1988 Up in Smoke? Cultural Resources and the Fires of 1987. *History Line* Spring 1988:11. USDA Forest Service, Washington, D.C. On file, Western Archeological and Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Post-burn.

Thoms, A. V.

1996 Forest Fires, Tree Wells, and Pedoturbation: Aspects of Natural Site Formation Processes in the Northern Rockies (Draft). Center for Ecological Archeology and Department of

Anthropology, Texas A&M University, College Station, Texas. Ms. on file, Western Archeological and Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/Fire effects/Subsurface effects.

Timmons, R. S.

ca. 1999 *Introduction to Fire Effects, Unit 4 Human Interface: Effects of Fire on Heritage Resources*. USDA Forest Service, Kootenai National Forest, Montana. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Burn management/Cultural resources/Fire effects.

1999 *Fire Effects on Prehistoric Artifacts: Northern Region/Intermountain Research Station Experiments Preliminary Research Design for Assessing Site Impacts*. USDA Forest Service, Region 1, Kootenai National Forest, Montana. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Soil/Thermoluminescence/Archaeomagnetic dating/Carbon 14/Bone/Ceramic, prehistoric/Charcoal/Obsidian hydration/Stone, artifactual/Obsidian.

Traylor, D. L.

1984 Effects of the La Mesa Fire on Bandelier's Cultural Resources. In *La Mesa Fire Symposium*, compiled by T. S. Foxx, pp. 97-102. Los Alamos National Laboratory, Los Alamos, New Mexico.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn.

Traylor, D., L. Hubbel, N. Wood, and B. Fiedler

1983 The La Mesa Fire: Impact on Cultural Resources at Bandelier National Monument. *CRM Bulletin* 6(4):5-7. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Fire suppression/Fire suppression, impact of/Post-burn.

1990 *The La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*. Southwest Cultural Resources Center Professional Papers No. 28. National Park Service, Division of Anthropology, Branch of Cultural Resource Management, Southwest Cultural Resources Center, Santa Fe.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Fire suppression/Fire suppression, impact of/Subsurface effects/Surface effects.

Trembour, F. N.

1990 Appendix F: A Hydration Study of Obsidian Artifacts, Burnt vs Unburnt by the La Mesa Forest Fire. In *The La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, pp. 174-190. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Archaeology/Archaeology/Cultural resources/Fire effects.

Trembour, F., and I. Friedman

1984 Obsidian Hydration Dating and Field Site Temperature. In *Obsidian Studies in the Great Basin*, edited by R. E. Hughes, pp. 79-90. Contributions of the University of California Archaeological Research Facility No. 45. Department of Anthropology, University of California, Berkeley.

Keywords: Archaeology/Archaeology/Cultural resources/Fire effects/Obsidian/Obsidian hydration/Stone, artifactual.

Turner, N. J.

1991 Burning Mountain Sides for Better Crops: Aboriginal Landscape Burning in British Columbia. *Archaeology in Montana* 32(2):54-74.

Keywords: Fire, historical use of/Archaeology/Cultural resources/Fire effects.

U.S. Army Engineer Waterways Experiment Station

1989 Effects of Forest Fires and Burn Programs on Archaeological Resources. *The Archaeological Sites Protection and Preservation Notebook*. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Vegetation/Fuel reduction/Prescribed burn.

U.S.D.A. Forest Service (Northern Region)

1994 *A Regional Framework: Ecosystem Management, the Heritage Resource Program Interface*. USDA Forest Service, Missoula, Montana. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Burn management/Soil/Vegetation.

U.S. Department of the Interior

1989 Final Report and Recommendations of the Fires Management Policy Review Team and Summary of Public Comments. *Federal Register* 54(115):25660-25678. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Architecture/Burn management/Fire suppression/Fire suppression, impact of.

1995 *Mount Vision Fire Incident Burned Area Emergency Rehabilitation (BAER) Plan*. U.S. Department of the Interior, Marin County, California. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Emergency rehabilitation/Burn management/Erosion/Fire effects/Fire suppression, impact of/Post-burn/Vegetation/Soil.

1996a *Chapin #5 Fire Burned Area Emergency Rehabilitation (BAER) Plan*. U.S. Department of the Interior, Mesa Verde National Park, Montezuma County, Colorado. On file Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Emergency rehabilitation/Burn management/Erosion/Fire effects/Fire suppression/Fire suppression, impact of/Fuel reduction/Post-burn/Vegetation/Site visibility/Soil.

1996b *Chino Well Fire Burned Area Emergency Rehabilitation (BAER) Plan*. U.S. Department of the Interior, Mescalero Apache Reservation, New Mexico. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Burn management/Vegetation/ Soil/Erosion/Fire suppression, impact of.

1996c *Dipping Vat Complex Burned Area Emergency Rehabilitation (BAER) Plan*. U.S. Department of the Interior, Rio Arriba County, New Mexico and Archuleta County, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Burn management/Vegetation/Soil/Erosion/Fuel reduction/Fire suppression, impact of.

1996d *Final Supplements: Amendment #1 to the Dipping Vat Complex BAER Plan, Revised Part D, Revised E Tables, Revised Log Terrace Specification Sheets, Addendum to the Soil and Watershed Assessment, Attachments to the Forestry Assessment and Straw Bale/Log Terrace Implementation Report*. U.S. Department of the Interior, Rio Arriba County, New Mexico and Archuleta County, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Cultural resources/Fire effects/Emergency rehabilitation/Burn management/Erosion/Soil/Vegetation/Fuel reduction/Fire suppression, impact of.

1998a *Oso Complex Burned Area Rehabilitation (BAER) Plan*. U.S. Department of the Interior, Rio Arriba and Sandoval Counties, New Mexico. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Burn management/Erosion/Soil/Vegetation/Fuel reduction/Fire suppression, impact of.

1998b *Supertyphoon Paka Emergency Rehabilitation Plan*. U.S. Department of the Interior, Guam. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Emergency rehabilitation/Erosion/Soil/Vegetation.

1999a *Rainbow Fire: Burned Area Emergency Rehabilitation Plan*. U.S. Department of the Interior, Whiteriver, Navaho County, Arizona. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Emergency rehabilitation/Burn management.

1999b *Snyder Fire: Burned Area Emergency Rehabilitation Plan*. U.S. Department of the Interior, Milford, Pike County, Pennsylvania. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Emergency rehabilitation/Fire effects/Fire suppression, impact of/Soil/Erosion/Vegetation.

2000a *Bircher Fire Burned Area Emergency Rehabilitation Plan*. U.S. Department of the Interior, Cortez, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Emergency rehabilitation/Burn management/Erosion/Fire suppression/Fire suppression, impact of/Fuel reduction/Post-burn/Vegetation/Soil.

2000b *Pony Fire Burned Area Emergency Rehabilitation Plan*. U.S. Department of the Interior, Cortez, Colorado. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archeology/Archaeology/Cultural resources/Fire effects/Emergency rehabilitation/Burn management/Erosion/Fire suppression/Fire suppression, impact of/Fuel reduction/Post-burn/Vegetation/Soil.

U.S. Geological Survey

1999 *USGS Study Casts Doubt on Role of Fire Suppression in Causing Catastrophic Shrubland Wildfires*. Biological Resources Division, Western Ecological Research Center, Sacramento. Available (Online):
<<http://biology.usgs.gov/pr/newsrelease/1999/6-8c.html>> [13 March 2001]. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Burn management/Fire cycle/Fire suppression/Fire suppression, impact of.

University of Arizona Soil and Water Testing Laboratory

1990 Appendix D: Analysis of the Soils From Sites on the La Mesa Fire Area. In *The La Mesa Fire Study: An Investigation of Fire and Fire Suppression Impact on Cultural Resources in Bandelier National Monument*, edited by D. Traylor, L. Hubbel, N. Wood, and B. Fiedler, pp. 165-171. Southwest Cultural Resources Center Professional Papers No. 28, National Park Service, Division of Anthropology, Branch of Cultural Resources Management, Santa Fe.

Keywords: Post-burn/Soil/Subsurface effects/Surface effects.

Welch, P., and T. Gonzales

1982 *Research Design, Prescribed Burn Impact, Evaluation Upon Cultural Resources, LMDA and Thing Mountain Chaparral Management Projects*. USDA Forest Service, Cleveland National Forest. On file, Cleveland National Forest, Escondido, California.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Prescribed burn/Obsidian/Obsidian hydration/Thermoluminescence/Vegetation/Erosion.

Wells, C. G., R. E. Campbell, L. F. DeBano, C. E. Lewis, E. C. Fredriksen, R. C. Froelich, and P. H. Dunn

1979 *Effects of Fire on Soil: A State-of-Knowledge Review, National Fire Effects Workshop, Denver*. General Technical Report No. WO-7. USDA Forest Service, Washington, D.C.
On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire effects/Soil.

Wendorf, M.

1982 The Fire Areas of Santa Rosa Island: An Interpretation. *North American Archaeologist* 3:173-180.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Wendtland, K. J.

1993 *Fire History and Effects of Seasonal Prescribed Burning on Northern Mixed Prairie, Scotts Bluff National Monument, Nebraska*. Unpublished Master's thesis, Department of Range Management, University of Wyoming, Laramie.

Keywords: Archaeology/Archeology/Fire effects/Cultural resources.

Wessel, R. L.

1985 *Assessment of the Impacts to Three Archaeological Sites in the Saugus Ranger District, Angeles National Forest*. USDA Forest Service, Cultural Resource Section, Angeles National Forest. On file, Supervisor's Office, Cultural Resource Section, Arcadia, and Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

Wettstaed, J. R.

1988 Forest Fires and Archaeology on the Ashland District, Custer National Forest, Montana. Paper presented at the 46th Annual Plains Anthropological Conference, Wichita.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

1989 The Schiller Fire Archaeology Project: A Final Summary. Paper presented at the Annual Plains Conference, Sioux Falls, South Dakota.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Site visibility.

1993 Forest Fires and Archaeological Sites: Observations From the 1988 Fire Season in Southeast Montana. *Archaeology in Montana* 34(1):7-16. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn.

Wettstaed, J. R., and H. Lapoint

1990 Short and Long Term Effects on Site Preservation Due to Wildfires. Paper presented at the Annual Meeting of the Society for American Archaeology, Las Vegas.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Post-burn/Fire suppression, impact of/Erosion/Vegetation.

Weymouth, J. W., and M. Manderville

1975 An X-ray Diffraction Study of Heat Treated Chert and its Archaeological Implications. *Archaeometry* 17(1):61-67.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

Whyte, T. R.

1983 Advantages and Disadvantages of Burned Lithic Artifacts in the Study of Archaeological Sites. Paper presented at the 40th Annual Southeastern Archaeological Conference, Columbia, South Carolina. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Stone, artifactual.

1984 *Lithic Artifact Burning and Archaeological Deposit Formation on Three Early Archaic Sites in East Tennessee*. Unpublished Master's thesis, Department of Anthropology, University of Tennessee, Knoxville.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects.

1990 An Experimental Study of Burned Fish Bones From Archaeological Sites. Paper presented at the Annual Meeting of the Society for American Archaeology, Las Vegas. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Bone.

Wickstrom, C. K. R.

1987 *Issues Concerning Native American Use of Fire: A Literature Review*. Publications in Anthropology No. 6. National Park Service, Yosemite National Park, Yosemite, California.

Keywords: Fire, historical use of.

Wilbur, R.

1988 The Burning Question: Report on the Effect of Burn Management Projects on Obsidian Hydration Rims. Paper presented at the Society for California Archaeology Annual Meeting, Reading. Ms. on file, Western Archeological & Conservation Center, Tucson.

Keywords: Archaeology/Archeology/Cultural resources/Fire effects/Obsidian hydration.

Williams, G. W.

1994 *References on the American Indian Use of Fire in Ecosystems*. Available (Online): <<http://wings.buffalo.edu/anthropology/Documents/firebib.txt>> [13 March 2001]. Ms. (accessed 21 March 2000) on file at Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of/Burn management.

2000a Early Fire Use in Oregon. *Fire Management Today* 60(3):13-20. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of.

2000b Introduction to Aboriginal Fire Use in North America. *Fire Management Today* 60(3):8-12. On file, Western Archeological & Conservation Center, Tucson

Keywords: Fire, historical use of.

2000c Reintroducing Indian-Type Fire: Implications for Land Managers. *Fire Management Today* 60(3):40-48. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire, historical use of/Burn management.

Wright, H. A., and A. W. Bailey

1982 *Fire Ecology, United States and Southern Canada*. John Wiley and Sons, New York.

Keywords: Fire effects/ Fire cycle/ Soil/ Vegetation.

Wuerthner, G.

1999 Friendly Fire. *Green Roots: The Newsletter of Forest Guardians* Summer(6):5. On file, Western Archeological & Conservation Center, Tucson.

Keywords: Fire cycle/Vegetation/Fire effects.